Warmhouse Beach Open Dump
Removal Assessment Report
Neah Bay, Clallam County, Washington

November 2010

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For

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LIST OF ACRONYMS

Acronym	Definition
ATSDR-SL	Agency of Toxic Substances and Disease Registry Screening Level
CLP	Contract Laboratory Program
COC	Contaminant of Concern
EPA	United States Environmental Protection Agency
°C	degrees Celsius
dioxins	polychlorinated dibenzodioxins
Eco SSL	EPA Ecological Soil Screening Levels
EPA-HAL	EPA Interim Drinking Water Health Advisory Level
GPS	global positioning system
MCL	Maximum Contaminant Level for drinking water
MEL	Manchester Environmental Laboratory, EPA Region 10
MT-FC	Makah Tribe Water Quality Standards - Freshwater Criterion Continuous Concentration
MT-HH	Makah Tribe Water Quality Standards - Human Health - Water + Organism
MTCA-A	Washington State Model Toxics Control Act – Method A for Unrestricted use
OSC	On-Scene Coordinator
PBDE	Polybrominated Diphenyl Ether
PCB	Polychlorinated Biphenyl
PRG-Carc	Preliminary Remediation Goal for carcinogens
PRG-Non-Carc	Preliminary Remediation Goal for non-carcinogens
RA	Removal Assessment
RSL	Regional Screening Level
RSL-RS	Regional Screening Level - Residential Soil
RSL-TW	Regional Screening Level - Tap Water
SPLP	Synthetic Precipitation Leaching Procedure
SQS	Washington State Sediment Quality Standards “no effects” level
START	Superfund Technical Assessment and Response Team
SVOCs	semi-volatile organic compounds
TAL	target analyte list
TEQ	toxic equivalency (for dioxins)
TPHs	total petroleum hydrocarbons
TSC-FC	Washington State Toxic Substances Criteria for freshwater chronic exposure
VOCs	volatile organic compounds
WQC-FC	National Recommended Water Quality Criteria - Freshwater Criterion Continuous Concentration
WQC-HH	National Recommended Water Quality Criteria - Human Health - Water + Organism

EXECUTIVE SUMMARY

The United States Environmental Protection Agency (EPA) directed TechLaw, Inc. to perform sampling in January 2010 for a Removal Assessment at Makah Reservation Warmhouse Beach Open Dump in Clallam County under the START 3 contract. The area targeted for assessment is a Dump previously used by the military for waste disposal and currently used by residents and businesses in Neah Bay the Makah Tribe for waste disposal. The Removal Assessment (RA) was performed to determine if contaminants of concern (COCs) are present at concentrations that present a risk to human health or the environment and whether they are migrating off-site. This removal assessment addressed chemical contaminants only and did not consider threats from fire, explosion, sharps, or microbes in medical or organic waste. This report describes the activities and summarizes the analytical results obtained during the RA. The RA finds that for the protection of human health, measures should be taken to prevent direct contact with and ingestion of the surface soils in the Dump.

1 SITE SUMMARY

The Warmhouse Beach Open Dump (the site) is located on Makah Reservation near the Strait of Juan de Fuca, approximately two miles northwest of Neah Bay, Washington. The site is currently used for waste disposal by the Makah Tribe and is surrounded by dense forest. The site is accessed from Neah Bay via a gravel road.

2 REMOVAL ASSESSMENT PARTICIPANTS

- United States Environmental Protection Agency (EPA)
- TechLaw, Inc. (START-3)
- Makah Tribe Environmental Division

3 SITE HISTORY

The Warmhouse Beach Open Dump is an uncontrolled landfill located about two miles northwest of Neah Bay and one quarter mile south of the Strait of Juan de Fuca at an elevation of approximately 260 feet above mean sea level on the northwest coast of the Makah Reservation. The dump is situated on a bluff, which is the drainage divide between West Creek to the southwest and East Creek to the southeast. The northernmost extent of the Dump is approximately 800 feet inland from the shoreline. The site is bordered by dense forest. West Creek discharges to the Strait at Warmhouse Beach and East Creek near Kydikabbit Point.

The Makah Air Force Station reportedly used the site from World War II until 1988, to dispose of household and various hazardous and toxic wastes, including paint cans, paint thinner, pesticides, lubricants, waste oil, asbestos-containing materials, empty barrels, and sewer sludge. Since 1988, members of the Makah Tribe, the US Coast Guard, Neah Bay residents and local businesses and other agencies operating in the area have continued to use the Dump for disposal of municipal and hazardous/toxic solid waste.

Dumping reportedly began in a deep ravine that runs east and west along the south edge of the Dump. A bedrock ridge is about 70 feet above the top of the ravine. Waste materials were originally dumped into the ravine from the access road on the ravine's south side. As the ravine filled with waste material, the access road was eventually extended to the top of the ridge. Since then, waste materials have been dumped from the top of the ridge down toward the ravine to the south. Some waste has also been dumped from the top of the ridge toward the north and northwest.

As of 2003, the volume of waste was estimated to be within a range of 55,000 to 65,000 cubic yards (Ridolfi 2008). Waste materials have continued to be deposited and the Dump is expected to reach capacity within the next few years.

The Makah Tribe has secured funding to build a transfer and recycling center in another location in the Neah Bay area (Ridolfi 2008). The transfer center is expected to be completed within the next few years after which the Warmhouse Beach Open Dump will not be used. The Dump will then require closure (covering and preventing off-site drainage from the waste). In the interim, if contaminants are migrating off-site into surface water, a removal action may be warranted to minimize or eliminate this occurrence to protect human health and the local ecosystem until the Dump can be officially closed.

4 PREVIOUS SITE INVESTIGATIONS

Through a series of sampling events performed with funding from the "Native American Lands Environmental Mitigation Program", East and West Creeks were identified as being impacted by contaminants from the Dump (Ridolfi 2009). During a site visit in May 2009, EPA On-Scene Coordinator (OSC) Kathy Parker observed the following materials at the Dump: household waste, batteries, electronic waste, appliances, medical waste, laboratory waste, bottles and barrels of petroleum products, herbicide containers, food waste, bottles of flammable liquids, and evidence of burning on the site including charred trees. See Appendix G for the May 2009 site visit photographic log. Conversations with tribal members indicated West Creek is used for spiritual purposes which can include ingestion of creek water. The Dump is also believed to be a source of contamination for fish and the shellfish beds in the area which are used by the Tribe and local fishermen (Ridolfi 2007).

5 EPA INVOLVEMENT

In April 2009, the Makah Tribal Council contacted the EPA Region 10 Administrator asking for EPA's help in closing the Warmhouse Beach Open Dump. In May 2010, OSC Kathy Parker, SAM Joanne Labaw and Tribal Solid Waste Coordinator Kristin Hall visited the Makah Tribe and the Warmhouse Beach Open Dump site to determine what EPA could do to help. EPA conducted a multi-agency meeting in June 2009 to help the Tribe determine a course of action. In October 2009, the Makah Tribal Council sent a letter to EPA requesting a Removal Assessment and a Preliminary Assessment (Makah 2009). This RA

report is a result of that request. A Preliminary Assessment was conducted concurrently with the RA and will be reported separately.

6 SAMPLE COLLECTION AND ANALYSIS

On January 25, 2010, EPA and START-3 mobilized from Port Orchard, Washington. The principle goals of the START-3 team, under the direction of the OSC, were to:

1. Collect surface water and sediment samples from West Creek and East Creek to determine if COCs are present at concentrations that present risk to human health or the environment and whether they are migrating off-site.
2. Collect surface soil samples from the Dump for the purpose of scoring the site according to the Hazard Ranking System (HRS) and also to determine the potential for COCs to run-off site during precipitation events. The HRS scoring was being performed under a Preliminary Assessment concurrently with the Removal Assessment and will be reported separately.

Figure 1 illustrates the sample locations. Global positioning system (GPS) coordinates were obtained for each sample collected, where possible. Due to the remote location and interference by forested areas, GPS coordinates could not be collected for all sample locations.

West Creek

Five equally spaced locations along West Creek were identified for sediment (0-4" below ground surface [bgs]) and surface water sample collection (locations WBW-01 through WBW-05). The location in West Creek closest to the site (WBW-01) was selected at the northwest toe of the filled area in order to capture representative run-off. The location in West Creek farthest from the site (WBW-05) was just upstream of a steep downward gradient of the creek. A sixth location was initially planned at the mouth of West Creek, however, the difficult terrain prevented the sampling team from collecting samples from this location.

A field duplicate (denoted WBW-07) was collected from location WBW-03 and additional sample volume was collected for a matrix spike/matrix spike duplicate (MS/MSD) at location WBW-02. Background sediment and surface water samples were collected from a creek along the road into the site (location WBB-06) and are not expected to be influenced by the site.

East Creek

Four equally spaced locations along East Creek were identified for sediment (0-4" bgs) and surface water sample collection (locations WBE-08 through WBE-11). The location in East Creek closest to the site (WBE-08) was selected at the first occurrence of flowing water. The location in East Creek farthest from the site (WBE-11) was just upstream of a steep downward gradient of the creek. Two additional locations were initially planned (one at the mouth of East creek) but, due to the limited length of the accessible portion of the creek, only four locations were sampled.

A field duplicate (denoted WBE-12) was collected from location WBE-09. Background sediment and surface water samples were collected from a creek along the road into the site (location WBB-13) and are not expected to be influenced by the site.

Dump Surface

Four surface soil samples were collected randomly on the surface of the Dump (locations WB-14 through WB-17). See Figure 1. A field duplicate (denoted WB-18) was collected from location WB-17.

Sample Processing and Analysis

One rinsate blank, one filter blank, and one trip blank per cooler containing samples for VOC analysis were prepared with reagent grade water provided by the EPA Seattle Warehouse to indicate the possible introduction of contamination during sampling activities.

All samples were stored on ice as soon as possible after collection. The surface water samples for dissolved metals and perchlorate analyses were field-filtered with 0.45 µm and 0.2 µm filtration units, respectively. Surface water samples for metals analysis were preserved in the field to a pH less than two with nitric acid.

Sediment samples were analyzed for target analyte list (TAL) metals, volatile organic compounds (VOCs), semi-volatile organics compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), explosives, polybrominated diphenyl ethers (PBDEs), total petroleum hydrocarbons (TPHs), and perchlorate. The four sediment samples closest to the site (WBW-01-SD, WBW-02-SD, WBE-08-SD, and WBE-09-SD) were also analyzed for polychlorinated dibenzodioxins (dioxins).

Surface water samples were analyzed for total and dissolved TAL Metals, VOCs, SVOCs, pesticides, PCBs, explosives, TPHs, and perchlorate.

Surface soil samples were analyzed for TAL Metals, VOCs, SVOCs, pesticides, PCBs, explosives, PBDEs, TPHs, perchlorate, and dioxins. Surface soil samples (excluding the duplicate) were also extracted using the Synthetic Precipitation Leaching Procedure (SPLP) EPA Method 1312, at the EPA's Manchester Environmental Laboratory (MEL). The SPLP extracts were analyzed for TAL metals, VOCs, and SVOCs. The SPLP method is designed to simulate leaching under acid rainwater conditions and is used to evaluate the potential for leaching metals from soil into groundwater and surface water.

A list of sample locations and their corresponding laboratory assigned sample names and location descriptions is provided in Table 1.

7 ANALYTICAL RESULTS AND DISCUSSION

Tables 2 through 7 show the analytical results for organic analytes; tables 8 through 14 show the metals results; tables 15 through 17 contain the TPH results; tables 18 through 20 show the perchlorate results; tables 22 and 23 show the dioxin results; and tables 24 through 26 show the PBDE results.

Organic Analytes

All surface water, sediment and surface soil samples were analyzed for VOCs, SVOCs, TPHs, pesticides, and PCBs. All 1,4-dioxane results from the sediment and surface soil samples were rejected due to low response factors for VOC analysis. For the West Creek sediments, only isopropylbenzene and benzo(a)pyrene were detected above the reporting levels. In the surface water samples from West Creek only 1,2-dichloroethane was detected above the reporting level.

For the East Creek sediments, 2-butanone, acetone, acenaphthylene, anthracene, benzo(a)pyrene, and fluorene were detected above the reporting level. In East Creek surface waters, no analytes were detected above the reporting levels.

For the surface soil samples collected from the Dump, several VOCs, SVOCs, pesticides, TPH diesel range, and TPH motor oil range were detected above the reporting levels.

Metal Analytes

All surface water, filtered surface water, sediment, and surface soil samples were analyzed for TAL metals. Silver recoveries were low in the aqueous matrix spikes (29% for filtered samples and 30% for unfiltered samples), therefore silver results in the water samples were either rejected (filtered samples) or qualified UJ as estimated non-detected (unfiltered samples). The zinc result for the filter blank (2.9 µg/L) was above the CRQL (2 µg/L). Dissolved zinc results less than ten times the concentration found in the filter blank (29 µg/L) are qualified JH to indicate they may be biased high due to blank contamination.

Water Hardness was used to adjust the sample results for ecological toxicity before comparing them to the WQC-FC action levels. Hardness was calculated from the calcium and magnesium results using the following equation:

$$\text{Hardness} = 2.5 * [Ca] + 4.1 * [Mg]$$

Where [Ca] is the calcium concentration and [Mg] is the magnesium concentration.

For the West Creek sediment samples, barium, cadmium, cobalt, copper, lead, manganese, mercury, nickel, silver, thallium, and zinc were elevated compared to background concentrations[1]. For the West Creek surface water samples, arsenic, barium, chromium, copper, lead, manganese, nickel, selenium, vanadium, and zinc were elevated compared to background.

For the East Creek sediment samples, only zinc was elevated when compared to background. In East Creek surface water samples, arsenic, barium, cadmium, lead, manganese, nickel, selenium, and zinc were elevated compared to background.

[1] Sample results are considered elevated when compared to background concentrations if a) the analyte is detected at or above the reporting limit and the analyte is not detected in the background sample or b) the analyte is detected in the background sample and the sample result is greater than three times the background result.

For the surface soil samples collected from the Dump, antimony, barium, cadmium, copper, lead, manganese, silver, and zinc were elevated compared to background.

Perchlorate

Perchlorate was elevated in all surface water samples collected from West and East Creeks and in two sediment samples collected from West Creek. The West Creek surface water sample results were approximately twenty times higher than the East Creek water sample results. No perchlorate was detected in the sediment samples from East Creek or the surface soil samples collected from the Dump.

Synthetic Precipitation Leaching Procedure (SPLP)

Table 21 shows the SPLP results for the four surface soil samples from the Dump which were prepared by SPLP and analyzed for VOCs, SVOCs, and metals. Fluorene, antimony, arsenic, barium, chromium, copper, lead, nickel, and zinc were detected above laboratory reporting levels in the SPLP leachates.

Dioxins

The two sediment samples collected closest to the Dump from each creek and the four surface soil samples from the Dump were analyzed for dioxins. The toxic equivalency (TEQ) was calculated by the laboratory for each sample.

Dioxins were detected in all of the samples. The TEQ for sample WB-15-SS, collected at the southeast end of the top of the Dump, was the highest at 2,300 ng/kg. The TEQ for sample WB-17-SS, collected at the toe of the Dump below sample WB-15-SS, was also elevated at 53.7 ng/kg. The TEQs for West Creek sediments (15.8 and 30.3 ng/kg) were substantially higher than the TEQs for East Creek sediments (1.5 and 0.982 ng/kg).

Polybrominated Diphenyl Ethers (PBDEs)

All sediment and surface soil samples were analyzed for PBDEs. BDE numbers 28, 47, 99, 100, 153, 154, 183, and 209 were elevated compared to background for the sediment samples collected from West Creek. BDE numbers 47 and 99 were elevated compared to background for sediment samples collected from East Creek. BDE numbers 47, 99, 100, 153, 154, 183, and 209 were elevated compared to background for the surface soil samples collected from the Dump.

Explosives

All surface water, sediment, and surface soil samples were analyzed for the following explosives analytes:

- 1,3,5-Trinitrobenzene
- 1,3-Dinitrobenzene
- 2,4,6-Trinitrotoluene
- 2,4-Dinitrotoluene

- 2,6-Dinitrotoluene
- 2-amino-4,6-Dinitrotoluene
- 2-Nitrotoluene
- 3-Nitrotoluene
- 4-amino-2,6-Dinitrotoluene
- 4-Nitrotoluene
- 3,5-Dinitrobenzenamine
- High melting explosive (HMX)
- Nitrobenzene
- Nitroglycerine
- Pentaerythritol tetranitrate (PETN)
- Research department explosive (RDX)
- 2,4,6-Trinitrophenylmethylnitramine (TETRYL)

No explosives were detected in any of the samples.

8 EVALUATION OF ANALYTICAL RESULTS

Screening Levels for Human Health Direct Contact

The Dump is frequently visited by people dropping off their solid waste and is also used for recreation. To address human health risk, analytical results for the sediment and surface soil samples were compared to the lowest of the following criteria:

1. Regional Screening Level - Residential Soil (RSL-RS)
2. Washington State Model Toxics Control Act, Method A cleanup levels for unrestricted use (MTCA-A)
3. Preliminary Remediation Goal for carcinogens, Recreational User (PRG-Carc)
4. Preliminary Remediation Goal for non-carcinogens, Recreational User (PRG-Non-Carc)
5. Agency for Toxic Substances and Disease Registry Screening Level (ATSDR-SL) for Dioxin toxic equivalency (TEQ)

Screening Levels for Human Health Consumption

The results obtained from the field events summarized in this report were compared to selected action levels. Waters from West Creek may be consumed as part of Tribal spiritual ceremonies, therefore analytical results for the surface water and SPLP samples were compared to the lowest of the following criteria:

1. Maximum Contaminant Levels for drinking water (MCL),
2. National Recommended Water Quality Criteria for human health consumption of water and organisms (WQC-HH)
3. Regional Screening Level - Tap Water (RSL-TW)

4. Makah Tribe Water Quality Standards - Human Health - Water + Organisms (MT-HH)
5. EPA Office of Water Interim Drinking Water Health Advisory Level (December 2008) for perchlorate (EPA-HAL)

Screening Levels for Ecological Risk

Analytical results for water samples were compared to the following criteria:

1. National Recommended Water Quality Criteria – Freshwater Criterion Continuous Concentration (WQC-FC),
2. State of Washington Surface Water Criteria for freshwater chronic exposure (TSC-FC),
3. Makah Tribe Water Quality Standards – Freshwater Criterion Continuous Concentration (MT-FC)

Analytical results for sediment samples were compared to the State of Washington Sediment Quality Standards – no effects level (SQS).

Analytical results for soil samples were compared to the EPA Ecological Soil Screening Levels (Eco SSL).

Samples Exceeding One or More Threshold(s)

Results above any screening level are presented in boldface in the results tables.

Analytical results exceeding the Regional Screening Levels:

- Arsenic in West Creek, East Creek and background waters, sediments and Dump surface soils,
- Benzo(a)pyrene in one West Creek sediment and four Dump surface soils,
- Antimony in one Dump surface soil,
- Cadmium in one West Creek sediment,
- Cobalt, manganese and thallium in two West Creek sediments,
- 1,2-dichloroethane for two West Creek waters,
- Perchlorate in five West Creek waters
- 2378-TCDD Dioxin for one Dump surface soil.

Analytical results exceeding the MTCA-A Levels:

- Cadmium in one Dump surface soil and two West Creek sediments.

Analytical results exceeding the WQC-HH Levels:

- Arsenic, bis(2-ethylhexyl)phthalate or antimony in two SPLP Dump soils,
- Arsenic in all West Creek, East Creek and background waters.

Analytical results exceeding MT-HH:

- Arsenic in all West Creek, East Creek, and background waters.
- Bis(2-ethylhexyl)phthalate in all four SPLP leachates.

Analytical results exceeding the EPA Office of Water Interim Drinking Water Advisory Level for perchlorate:

- All six surface water samples from West Creek.

Analytical results exceeding the PRG-Carc Levels:

- Four dioxins in one Dump soil.

Analytical results exceeding the ATSDR-SL action level for the dioxin toxic equivalency (TEQ):

- Two Dump surface soil samples.

Analytical results exceeding SQS:

- One sediment in West Creek for cadmium and mercury.
- Two sediments in West Creek and two sediments in East Creek for zinc.

Analytical results exceeding federal, state, or local ecological levels for freshwater chronic exposure:

- Selenium in three surface waters from West Creek and one surface water from East Creek.
- Lead in two SPLP leachates (federal levels only).
- Copper in one SPLP leachate (MT-FC only).

Analytical results exceeding Eco SSL:

- Lead and zinc in all Dump surface soil samples.
- Antimony and cadmium in four Dump surface soil samples.
- Cobalt in three Dump surface soil samples.
- Nickel in one Dump surface soil samples.
- Total chromium for trivalent chromium in all surface soil samples including the background sample.
- Copper, manganese, and vanadium in all surface soil samples including the background sample.

Exceedances by Area

Analyte concentrations in West Creek for benzo(a)pyrene, 1,2-dichloroethane, arsenic, cadmium, cobalt, manganese, thallium and perchlorate were slightly above Regional Screening Levels. Of these, only cadmium in the two sediments closest to the head waters of West Creek exceeded the MTCA-A threshold. Only arsenic in the waters exceeded the WQC-HH threshold, however, arsenic was also found in both background samples. Perchlorate in West Creek waters exceeded both the EPA-HAL and RSL-TW levels. Analyte concentrations in West Creek for cadmium, mercury, and zinc exceeded the Washington Sediment Quality Standards for ecological risk. Selenium and arsenic in West Creek waters exceeded federal and state ecological levels for freshwater chronic exposure.

Analyte concentrations in East Creek for arsenic exceeded the RSL and the WQC-HH threshold. There were no MTCA-A exceedances in the waters or sediments in East

Creek. Zinc in East Creek sediments exceeded the Washington SQS for ecological risk. Selenium and arsenic in East Creek waters exceeded federal and state ecological levels for freshwater chronic exposure.

Surface soil samples collected from the Dump were above RSLs for benzo(a)pyrene, arsenic, antimony, cadmium and one dioxin (2378 TCDD). Of these, only cadmium exceeded the MTCA-A threshold. Only dioxins exceeded the PRG-Carc and ATSDR-SL thresholds.

Surface soil samples collected from the Dump were above Eco SSL for antimony, cadmium, chromium, cobalt, copper, lead, manganese, nickel, vanadium, and zinc,.

SPLP extracts from surface soils in the Dump were above WQC-HH thresholds for bis(2-ethylhexyl)phthalate, antimony and arsenic and above ecological thresholds for bis(2-ethylhexyl)phthalate, copper and lead.

Magnitude of Exceedances for Contaminants of Concern (COC):

West Creek Waters

COC	Type of Threshold Value	Threshold	Units	Back-ground	Number of exceedance samples	Range of Results
Arsenic	RSL-TW WQC-HH MT-HH	0.045 0.018 0.0048	µg/L	<1	6 6 6	1.1-1.5
Selenium	WQC/FC TSC-FC	5	µg/L	<5	3	4.1-5.4
Perchlorate	RSL-TW EPA-HAL	26 15	µg/L	<0.1	5 6	26.6-52.9
1,2-dichloroethane	RSL-TW	0.15	µg//L	<0.5	2	0.19-1.1

West Creek Sediments

COC	Type of Threshold Value	Threshold	Units	Back-ground	Number of exceedance samples	Range of Results
Arsenic	RSL-RS	0.39	mg/kg	4.7	6	4.2-13.4
Cadmium	MTCA-A SQS	2 5.1	mg/kg	<1.1	2 1	2.7-6.0
Cobalt	RSL-RS	23	mg/kg	8.0	2	47.2-68.7
Manganese	RSL-RS	1800	mg/kg	188	2	10,000-26,500
Mercury	SQS	0.41	mg/kg	0.13	1	0.1-0.48
Thallium	RSL-RS	5.1	mg/kg	1.8	2	5.2-6.3
Zinc	SQS	410	mg/kg	62.6	2	62.6-2,610
Benzo(a)pyrene	RSL-RS	15	µg/kg	6.7	1	27

East Creek Waters

COC	Type of Threshold Value	Threshold	Units	Back-ground	Number of exceedances samples	Range of Results
Arsenic	RSL-TW WQC-HH MT-HH	0.045 0.018 0.0048	µg/L	0.28	5 5 5	1.0-1.4
Selenium	WQC/FC TSC-FC	5	µg/L	<0.4	1	4.0-5.2

East Creek Sediments

COC	Type of Threshold Value	Threshold	Units	Back-ground	Number of exceedances samples	Range of Results
Arsenic	RSL-RS	0.39	mg/kg	5.1	5	2.3-4.8
Zinc	SQS	410	mg/kg	81.8	2	81.8-477

Surface Soils in the Dump:

COC	Type of Threshold Value	Threshold	Units	Back-ground	Number of exceedances samples	Range of Results
Antimony	Eco SSL-Mammalian	0.27	mg/kg	<15.1	4	1.2-33.7
Arsenic	RSL-RS	0.39	mg/kg	8	5	6.1-9.6
Antimony	RSL-RS	31	mg/kg	15.1	1	33.7
Cadmium	MTCA-A Eco SSL-Mammalian	2 0.36	mg/kg	<1.3	1 4	10.8 0.54-10.8
Chromium	Eco SSL Avian	26 (Cr(III))	mg/kg	31.9	5	27.5-44.5
Cobalt	Eco SSL Plants	13	mg/kg	6.1	3	13.1-15.3
Copper	Eco SSL Avian	28	mg/kg	30.2	5	69.7-520
Lead	Eco SSL Avian	11	mg/kg	10.6	5	23.5-137
Manganese	Eco SSL Plants	220	mg/kg	274	5	346-954
Nickel	Eco SSL Plants	38	mg/kg	14.1	1	40.7
Vanadium	Eco SSL Avian	7.8	mg/kg	78.3	5	35.5-83.8
Zinc	Eco SSL Avian	46	mg/kg	39.2	5	80.7-923
Dioxin: 2378 TCDD	RSL-RS	4.5	ng/kg	NA	1	150
Dioxins	PRG-Carc	128-641	ng/kg	NA	1	763-1450
Dioxin - TEQ	ATSDR-SL	50	ng/kg	NA	2	53.7-2300
Benzo(a)pyrene	RSL-RS	15	µg/kg	<9.1	4	27-59

SPLP for Surface Soils in the Dump:

COC	Type of Threshold Value	Threshold	Units	Number of exceedances samples	Range of Results
Bis(2-ethylhexyl)phthalate	WQC-HH MT-HH	1.2 0.24	µg/L	1 4	0.59-2.1
Antimony	RSL-TW	15	µg/L	1	10.2-20.3
	WQC-HH	5.6		2	
Arsenic	RSL-TW	0.045	µg/L	1	0.9
	WQC-HH	0.018		1	
Copper	MT-FC	9	µg/L	1	15.3
Lead	WQC-FC	2.5	µg/L	2	3.5-3.7

9 DISCUSSION OF ANALYTICAL RESULTS AND REMOVAL ACTION RECOMMENDATION

This removal assessment addressed chemical contaminants only and did not consider human health or ecological threats from fire, explosion, sharps, or microbes in medical or organic waste.

Human Health Risk by Direct Contact

Results of target analytes in soil from the Dump and creek sediments were compared to background concentrations and potentially applicable screening criteria for human health risk by direct contact. The following analytes were detected above screening criteria and were also elevated above background concentrations:

- The toxic equivalency for dioxin exceeds the ATSDR screening level in two surface soil samples from the Dump.
- Benzo(a)pyrene exceeded the RSL-RS in one sediment sample from West Creek and four surface soil samples from the Dump.
- Cadmium exceeded the MTCA-A level in two sediment samples from West Creek and one surface soil sample from the Dump.
- Cobalt and manganese exceeded the RSL-RS in two sediment samples from West Creek.
- Thallium exceeded the RSL-RS in one sediment sample from West Creek.
- Antimony exceeded the RSL-RS in one surface soil sample from the Dump.

Human Health Risk by Ingestion

Results of target analytes in surface water samples from the creeks were compared to background concentrations and appropriate screening criteria for human health risk from ingestion. The following analytes were detected above screening criteria and were also elevated above background concentrations:

- Perchlorate exceeded the RSL-TW (five samples) and the EPA-HAL (six samples) in surface water samples from West Creek.
- Arsenic was elevated above background and exceeded the RSL-TW, WQC-HH, and MT-HH in all surface water samples collected from the West and East Creeks.
- 1,2-dichloroethane exceeded the RSL-TW, WQC-HH, and MT-HH in one surface water sample from West Creek.

Ecological Risk

Results of target analytes in all samples were compared to background concentrations and appropriate screening criteria for ecological risk. The following analytes were detected above screening criteria and were also elevated above background concentrations:

- Cadmium and zinc exceeded Washington SQS in two sediment samples from West Creek.
- Zinc exceeded the SQS in two sediment samples from East Creek.
- Selenium exceeded federal and state ecological criteria in three surface water samples from West Creek and one surface water sample from East Creek.

- Antimony (one sample), cadmium (one sample), copper (three samples), lead (four samples), manganese (one sample), and zinc (four samples) exceeded Eco SSL in surface soil samples from the Dump.

Due to high annual precipitation in the area (100.5 inches in Neah Bay, WRCC 2010), it is possible the spread of contaminated surface soil from the Dump through the creeks is impacting the shellfish living in the beach sediments of Warmhouse Beach, which contribute to subsistence consumption by the Makah Indian Tribe.

According to the Makah Seafood Study (Ridolfi 2007), shellfish collected at Warmhouse Beach contained arsenic and cadmium above Region 3 Risk Based Concentrations for tissue. For that study, a limited number of shellfish were collected from the reference site and it could not be determined if the concentrations of arsenic and cadmium in shellfish from Warmhouse Beach were significantly above reference levels. The arsenic and cadmium concentrations were approximately twice the concentrations in shellfish collected at beaches on the Pacific Ocean.

Removal Action Recommendations:

This removal assessment identified numerous exceedances of the Regional Screening Levels (RSLs), which represent a one in a million health risk ($1x10^{-6}$). However, the exceedances in the SPLP extracts and the samples from areas that represent off-site migration (waters and sediments in the creeks) were generally within one order of magnitude of the RSLs except for arsenic, which were less than two orders of magnitude. Removal Action Levels are generally set at $1x10^{-4}$, therefore a removal action to address the contamination moving off-site is not justifiable based on this data.

The exceedances in the surface soil samples taken from the Dump were substantially higher than the screening levels, and in the case of antimony, more than two orders of magnitude above the ecological screening level. The greatest threat to human health by direct contact with these surface soils is from the presence of arsenic and dioxins. For the protection of human health, measures should be taken to prevent direct human contact with and ingestion of the surface soils in the Dump.

This removal assessment addressed chemical contaminants only and did not consider threats from fire, explosion, sharps, or microbes in medical or organic waste

10 REFERENCES

Makah Tribal Council (Makah), October 22, 2009. Correspondence from Michael Lawrence, Makah Tribal Council, to Michelle Pirzadeh, EPA, regarding Makah Tribe's Petition for Preliminary Assessment of Warmhouse Beach Uncontrolled landfill on the Makah Indian Reservation and Request for Removal Assessment.

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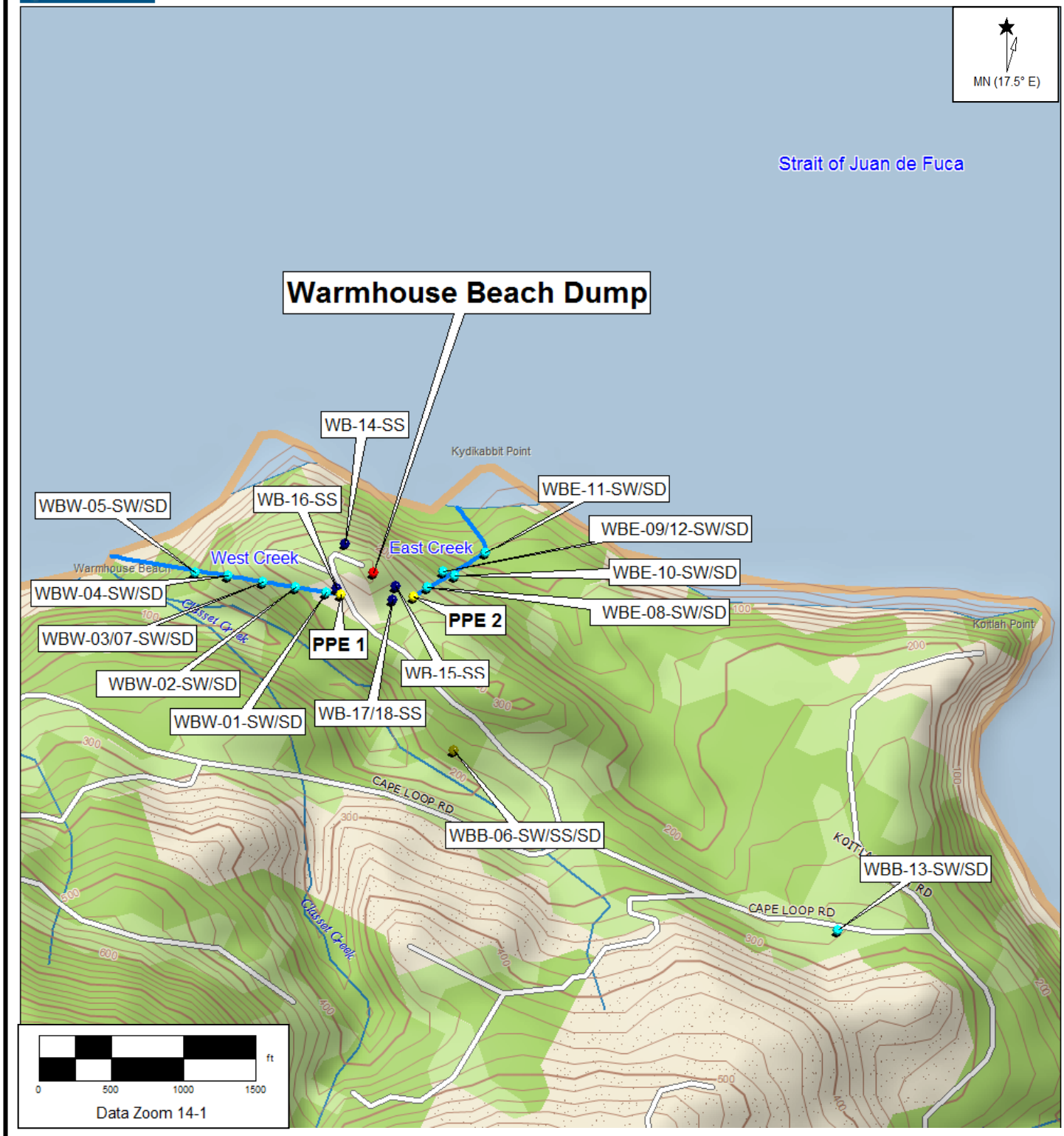
Western Regional Climate Center, 2010. Period of Record Monthly Climate Summary, Period of Record: 10/1/1929 to 4/30/1987, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wa5801, accessed November 29, 2010.



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TechLaw
Quality & Integrity

Legend

- Site Location
- PPE
- SW & SD Sample
- SS Sample
- SW, SS, & SD Sample

Neah Bay, Clallam County, Washington

Figure 1
Sample Location Map
Warmhouse Beach Open Dump

Neah Bay, Clallam County, Washington

Table 1. Sample Identification Key
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

Sample Matrix	CLP Sample Identification - Organics	CLP Sample Identification - Inorganics	MEL Sample Identification	Sample Location	Sample Type	Location Description
Sediment	JC667	MJC667	10044217	WBW-01-SD	Sample	West Creek, nearest to dump
	JC668	MJC668	10044218	WBW-02-SD	Sample	West Creek, 2nd nearest
	JC669	MJC669	10044219	WBW-03-SD	Sample	West Creek, 3rd nearest
	JC670	MJC670	10044220	WBW-04-SD	Sample	West Creek, 4th nearest
	JC671	MJC671	10044221	WBW-05-SD	Sample	West Creek, 5th nearest
	JC672	MJC672	10044222	WBW-07-SD	Field Duplicate	West Creek, 3rd nearest
	JC657	MJC657	10044209	WBB-06-SD	Background	1000 feet southeast of dump
	JC660	MJC660	10044212	WBE-08-SD	Sample	East Creek, nearest to dump
	JC662	MJC662	10044213	WBE-09-SD	Sample	East Creek, 2nd nearest
	JC663	MJC663	10044214	WBE-10-SD	Sample	East Creek, 3rd nearest
	JC665	MJC665	10044215	WBE-11-SD	Sample	East Creek, 4th nearest
	JC666	MJC666	10044216	WBE-12-SD	Field Duplicate	East Creek, 2nd nearest
	JC659	MJC659	10044211	WBB-13-SD	Background	4000 feet southeast of dump
Surface Water	JC628	MJC628	10044237	WBW-01-SW	Sample - unfiltered	West Creek, nearest to dump
	JC645	MJC645	10044238		Sample - filtered	
	JC629	MJC629	10044239	WBW-02-SW	Sample - unfiltered	West Creek, 2nd nearest
	JC646	MJC646	10044240		Sample - filtered	
	JC630	MJC630	10044241	WBW-03-SW	Sample - unfiltered	West Creek, 3rd nearest
	JC647	MJC647	10044242		Sample - filtered	
	JC631	MJC631	10044243	WBW-04-SW	Sample - unfiltered	West Creek, 4th nearest
	JC648	MJC648	10044244		Sample - filtered	
	JC632	MJC632	10044245	WBW-05-SW	Sample - unfiltered	West Creek, 5th nearest
	JC649	MJC649	10044246		Sample - filtered	
	JC633	MJC633	10044247	WBW-07-SW	Field Duplicate - unfiltered	West Creek, 3rd nearest
	JC650	MJC650	10044248		Field Duplicate - filtered	
	JC621	MJC621	10044223	WBB-06-SW	Background - unfiltered	1000 feet southeast of dump
	JC638	MJC638	10044224		Background - filtered	
	JC623	MJC623	10044227	WBE-08-SW	Sample - unfiltered	East Creek, nearest to dump
	JC640	MJC640	10044228		Sample - filtered	
	JC624	MJC624	10044229	WBE-09-SW	Sample - unfiltered	East Creek, 2nd nearest
	JC641	MJC641	10044230		Sample - filtered	
	JC625	MJC625	10044231	WBE-10-SW	Sample - unfiltered	East Creek, 3rd nearest
	JC642	MJC642	10044232		Sample - filtered	
	JC626	MJC626	10044233	WBE-11-SW	Sample - unfiltered	East Creek, 4th nearest
	JC643	MJC643	10044234		Sample - filtered	
	JC627	MJC627	10044235	WBE-12-SW	Field Duplicate - unfiltered	East Creek, 2nd nearest
	JC644	MJC644	10044236		Field Duplicate - filtered	
	JC622	MJC622	10044225	WBB-13-SW	Background - unfiltered	4000 feet southeast of dump
	JC639	MJC639	10044226		Background - filtered	
Surface Soil	JC651	MJC651	10044204	WB-14-SS	Sample	North edge of upper dump
	JC652	MJC652	10044205	WB-15-SS	Sample	Southeast edge of upper dump
	JC653	MJC653	10044206	WB-16-SS	Sample	Center of dump west of road
	JC655	MJC655	10044207	WB-17-SS	Sample	Southeast toe of dump
	JC656	MJC656	10044208	WB-18-SS	Field Duplicate	Southeast toe of dump
	JC658	MJC658	10044210	WBB-06-SS	Background	1000 feet southeast of dump

Table 2

Organic Analytical Results Summary - Sediment Samples - West Creek

Warmhouse Beach Open Dump

Neah Bay, Clallam County, Washington

CLP Sample ID						JC657		JC667		JC668		JC669		JC670		JC671		JC672	
Location ID						WBB-06-SD		WBW-01-SD		WBW-02-SD		WBW-03-SD		WBW-04-SD		WBW-05-SD		WBW-07-SD	
Sample Date						1/26/2010		1/26/2010		01/26/10		01/26/10		01/26/10		01/26/10		01/26/10	
Location						Background		West Creek											
	Human Health				Ecological														
	RSL-RS	MTCA-A	PRG-Carc	PRG-Noncarc	SQS														
Volatile Organic Compounds (µg/kg)																			
Isopropylbenzene	2,200,000			230,000,000		19	U	850		43	U	9.7	U	11	U	18	U	11	U
Styrene	6,500,000			703,000,000		19	U	8.4	JQ	43	U	9.7	U	11	U	18	U	11	U
Toluene	5,000,000	7,000		556,000,000		2.3	JQ	8.3	JQ	43	U	1.3	JQ	11	U	2.5	JQ	11	U
Semivolatile Organic Compounds (µg/kg)																			
Benzo(a)pyrene	15			RSL	99,000	6.7	U	**27**		16	UJK	6		5.6	UJK	5.9	UJK	7.7	U
Pesticide and PCB (µg/kg)																			
4,4'-DDD	2,000		34,700	2,270,000		6.5	U	2	JQ	1.1	JQ	5.6	U	5.6	U	5.9	U	0.099	JQ
Aldrin	29		491	34,000		3.3	U	10	U	8.3	U	2.9	U	2.9	U	0.068	JQ	0.059	JQ
alpha-BHC	77		1,320			3.3	U	0.27	JQ	8.3	U	2.9	U	0.038	JQ	0.13	JQ	0.087	JQ
alpha-Chlordane	1,600					3.3	U	10	U	0.55	JQ	2.9	U	2.9	U	0.089	JQ	3.9	U
Aroclor - 1254	220		3,080	16,800		67	U	56	JQ	30	JQ	58	U	55	U	58	U	75	U
delta-BHC						3.3	U	0.4	JQ	8.3	U	2.9	U	2.9	U	3	U	3.9	U
Endosulfan I						3.3	U	0.62	JQ	8.3	U	2.9	U	2.9	U	3	U	3.9	U
Endosulfan II						6.5	U	20	U	1.1	JQ	5.6	U	5.6	U	0.14	JQ	7.5	U
Endosulfan sulfate						6.5	U	20	U	16.6	U	0.14	JQ	0.051	JQ	5.9	U	7.5	U
Endrin ketone						6.5	U	0.8	JQ	16.6	U	5.6	U	5.6	U	5.9	U	7.5	U
gamma-BHC(Lindane)	520	10	16,100	713,000		3.3	U	0.26	JQ	8.3	U	2.9	U	2.9	U	3	U	3.9	U
gamma-Chlordane	1,600					3.3	U	0.22	JQ	0.2	JQ	2.9	U	2.9	U	3	U	3.9	U
Heptachlor	110		1,850	567,000		3.3	U	10	U	8.3	U	2.9	U	0.072	JQ	3	U	0.1	JQ

Key:

Bold = Concentration exceeds action level

Underlined = Concentration elevated when compared to background

µg/kg = Micrograms per kilogram

CLP Sample ID = Contract Laboratory Program sample identification number

J = The analyte was positively identified. The associated numerical result is an estimate.

K = Unknown bias

Location ID = START-3 sample identification number

MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels

PRG-Carc = Preliminary Remediation Goal - Carcinogen

PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen

Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.

RSL-RS = Regional Screening Level - Residential Soil

SD = Sediment

SQS= Washington State Sediment Quality Standards "no effects" level

U = Analyte was not detected above the level of the associated value.

WBB = Warmhouse Beach Background

WBW = Warmhouse Beach West Creek

Table 3
Organic Analytical Results Summary - Surface Water Samples - West Creek
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID							JC621		JC628		JC629		JC630		JC631		JC632		JC633	
Location ID							WBB-06-SW		WBW-01-SW		WBW-02-SW		WBW-03-SW		WBW-04-SW		WBW-05-SW		WBW-07-SW	
Sample Date							1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010	
Location							Background		West Creek											
	Human Health				Ecological															
	MCL	RSL-TW	WQC-HH	MT-HH	WQC-FC	TSC-FC														
Volatile Organic Compounds (µg/L)																				
1,2-Dichloroethane	5	0.15	0.38	0.35			0.5	U	**1.1**		**0.19**	JQ	0.5	U	0.5	U	0.5	U	0.083	JQ
Pesticide and PCB (µg/L)																				
Endosulfan II			62	10	0.056	0.056	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.0053	JQ

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/L = Micrograms per liter
CLP Sample ID = Contract Laboratory Program sample identification number
MT-HH = Makah Tribe Water Quality Standards - Human Health - Water + Organism
ID = Identification
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
MCL = Maximum Contaminant Level (Drinking Water)
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-TW = Regional Screening Level - Tap Water
SW = Surface Water
TSC-FC = State of Washington Toxic Substances Criteria - Freshwater Chronic
U = Analyte was not detected above the level of the associate
WBB = Warmhouse Beach Background
WBW = Warmhouse Beach West Creek
WQC-FC = Federal Water Quality Criteria - Freshwater Continuous Chronic Criteria
WQC-HH = Federal Water Quality Criteria - Human Health - Water + Organism

Table 4
Organic Analytical Results Summary - Sediment Samples- East Creek
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID						JC659		JC660		JC662		JC663		JC665		JC666	
Location ID						WBB-13-SD		WBE-08-SD		WBE-09-SD		WBE-10-SD		WBE-11-SD		WBE-12-SD	
Sample Date						1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		01/27/10	
Location						Background		East Creek									
	Human Health				Ecological												
	RSL-RS	MTCA-A	PRG-Carc	PRG-Noncarc	SQS												
Volatile Organic Compounds (µg/kg)																	
1,1-Dichloroethene	250,000		6,420	27,300,000		2.9	JQ	1	JQ	6.8	U	1	JQ	12	U	15	U
2-Butanone	28,000,000			3,120,000,000		39	U	33		14	U	21		37		60	
Acetone	61,000,000			7,880,000,000		170	U	340		37	U	59	U	220		130	U
Isopropylbenzene	2,200,000			230,000,000		2.7	JQ	9.8	U	6.8	U	7.9	U	12	U	15	U
Toluene	5,000,000	7,000		556,000,000		20	U	1.1	JQ	0.89	JQ	0.91	JQ	1.3	JQ	1.8	JQ
Semivolatile Organic Compounds (µg/kg)																	
Acenaphthylene					66,000	9.6	U	6.1	U	5	U	3.9	U	6.3	JK	5.4	UJK
Anthracene	17,000,000			270,000,000	220,000	9.6	U	6.1	U	5	U	3.9	U	18	JK	5.4	UJK
Benzo(a)Pyrene	15	100	224		99,000	9.6	U	6.1	U	6.5		3.9	U	6.1	U	5.4	U
Fluorene	2,300,000			36,000,000	23,000	9.6	U	6.1	U	5	U	3.9	U	7.5	JK	5.4	UJK
Pesticide and PCB (µg/kg)																	
4,4'-DDD	2,000		34,700	2,270,000		9.6	U	0.07	JQ	4.9	U	3.8	U	6.2	U	0.048	JQ
Aldrin	29		491	34,000		5	U	3.1	U	0.051	JQ	0.05	JQ	3.1	U	0.053	JQ
alpha-BHC	77		1,320			5	U	3.1	U	2.5	U	1.9	U	3.1	U	0.035	JQ
alpha-Chlordane	1,600					5	U	3.1	U	2.5	U	1.9	U	0.057	JQ	2.7	U
delta-BHC						0.2	JQ	3.1	U	2.5	U	0.07	JQ	0.2	JQ	2.7	U
Endosulfan I						0.18	JQ	3.1	U	2.5	U	1.9	U	0.13	JQ	2.7	U
Endosulfan sulfate						0.13	JQ	6.1	U	4.9	U	3.8	U	6.2	U	0.096	JQ
Endrin	18,000			340,000		9.6	U	6.1	U	4.9	U	3.8	U	0.13	JQ	5.3	U
Endrin ketone						9.6	U	6.1	U	4.9	U	0.04	JQ	6.2	U	5.3	U
gamma-BHC(Lindane)	520	10	16,100	713,000		5	U	3.1	U	2.5	U	0.15	JQ	1.3	JQ	2.7	U
gamma-Chlordane	1,600					5	U	3.1	U	2.5	U	0.02	JQ	3.1	U	2.7	U
Heptachlor	110		1,850	567,000		5	U	3.1	U	0.046	JQ	0.03	JQ	3.1	U	2.7	U

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/kg = Micrograms per kilogram
CLP Sample ID = Contract Laboratory Program sample identification number
ID = Identification
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SD = Sediment
SQS= Washington State Sediment Quality Standards "no effects" level
U = Analyte was not detected above the level of the associated value
WBB = Warmhouse Beach Background
WBE = Warmhouse Beach East Creek

Table 5
Organic Analytical Results Summary - Surface Water Samples - East Creek
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID							JC622		JC623		JC624		JC625		JC626		JC627	
Location ID							WBB-13-SW		WBE-08-SW		WBE-09-SW		WBE-10-SW		WBE-11-SW		WBE-12-SW	
Sample Date							1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location							Background		East Creek									
	Human Health				Ecological													
	MCL	RSL-TW	WQC-HH	MT-HH	WQC-FC	TSC-FC												
Semivolatile Organic Compounds (µg/L)																		
Acenaphthene		2,200	670	120			0.1	U	0.1	U	0.1	U	0.1	U	0.084	JQ	0.1	U
Pyrene			830	340			0.1	UJK	0.07	JQ	0.1	U	0.1	U	0.1	UJK	0.1	U

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/L = Micrograms per liter
CLP Sample ID = Contract Laboratory Program sample identification number
MT-HH = Makah Tribe Water Quality Standards - Human Health - Water + Organism
ID = Identification
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
MCL = Maximum Contaminant Level (Drinking Water)
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-TW = Regional Screening Level - Tap Water
SW = Surface Water
TSC-FC = State of Washington Toxic Substances Criteria - Freshwater Chronic
U = Analyte was not detected above the level of the associated value.
WBB = Warmhouse Beach Background
WBE = Warmhouse Beach East Creek
WQC-FC = Federal Water Quality Criteria - Freshwater Continuous Chronic Criteria
WQC-HH = Federal Water Quality Criteria - Human Health - Water + Organism

Table 6
Organic Analytical Results Summary - Surface Soil Samples - VOCs and SVOCs
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID							JC658		JC651		JC652		JC653		JC655		JC656	
Location ID							WBB-06-SS		WB-14-SS		WB-15-SS		WB-16-SS		WB-17-SS		WB-18-SS	
Sample Date							1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location							Background		Waste Pile									
	Human Health				Ecological													
	RSL-RS	MTCA-A	PRG-Carc	PRG-Noncarc	Eco SSL	Eco SSL Species												
Volatile Organic Compounds (µg/kg)																		
1,1-Dichloroethene	250,000		6,420	27,300,000			2.7	JQ	0.76	JQ	1.1	JQ	1.2	JQ	6.8	U	9.6	U
2-Butanone	28,000,000			3,120,000,000			27	JQ	11	U	24		14	U	25		27	
Benzene	1,100	30	121,000	9,660,000			21	U	5.3	U	4	JQ	6.9	U	6.8	U	9.6	U
Cyclohexane	7,200,000			786,000,000			21	U	5.3	U	7.8	U	6.9	U	6.2	JQ	9.6	U
Ethylbenzene	5,700	6,000	603,000	393,000,000			21	U	5.3	U	0.85	JQ	6.9	U	0.84	JQ	0.98	JQ
m,p-Xylene	4,500,000			469,000,000			21	U	5.3	U	0.99	JQ	6.9	U	2.2	JQ	2.9	JQ
Methylcyclohexane				373,000,000			21	U	5.3	U	7.8	U	6.9	U	11		9.6	U
o-Xylene	5,300,000			550,000,000			21	U	5.3	U	7.8	U	6.9	U	1.1	JQ	1.4	JQ
Styrene	6,500,000			703,000,000			21	U	5.3	U	7.8	U	0.82	JQ	6.8	U	9.6	U
Toluene	5,000,000	7,000		556,000,000			21	U	5.3	U	5.1	JQ	6.9	U	2.3	JQ	3.3	JQ
Semivolatile Organic Compounds (µg/kg)																		
2-Methylnaphthalene	310,000			35,000,000	29,000	Soil Invertebrates	9.1	U	3.9	U	3.8	JQ	4.3	U	14		8.2	
4-Methylphenol	310,000			5,670,000			470	U	200	U	260	U	440	U	120	JQ	76	JQ
Acenaphthene	3,400,000			54,000,000	29,000	Soil Invertebrates	9.1	U	1.2	U	5.2		4.3	U	14		12	
Acenaphthylene					29,000	Soil Invertebrates	9.1	U	3.9	U	5	U	4.3	U	4.6	U	2.6	JQ
Acetophenone	7,800,000			150,000			470	U	3.3	JQ	47	JQ	99	JQ	480	U	230	U
Anthracene	17,000,000			270,000,000	29,000	Soil Invertebrates	9.1	U	3.3	JQ	2.8	JQ	2.5	JQ	21		17	
Benzo(a)anthracene	150		1,360		1,100	Mammalian	9.1	U	28		5.8		5.9		58		55	
Benzo(a)Pyrene	15	100	224		1,100	Mammalian	9.1	U	**27**		**33**		11		**59**		**45**	
Benzo(b)fluoranthene	150		1,360		1,100	Mammalian	9.1	U	29		9.9		11		60		32	
Benzo(g,h,i)perylene					1,100	Mammalian	9.1	U	7.4		5	U	6.2		18		16	
Benzo(k)fluoranthene	1,500		1,360		1,100	Mammalian	9.1	U	11		4.5	JQ	3.5	JQ	22		20	
Bis(2-ethylhexyl)phthalate	35,000		596,000	22,700,000			470	U	63	JQ	260	U	110	JQ	2,200		410	
Butylbenzylphthalate			4,390,000	227,000,000			470	U	200	U	260	U	440	U	130	JQ	61	JQ
Chrysene	15,000		13,600		1,100	Mammalian	9.1	U	18		16		15		86		52	
Dibenzo(a,h)anthracene	15		399		1,100	Mammalian	9.1	U	4.5		5	U	4.3	U	4.6	U	4.4	U
Di-n-butylphthalate	6,100,000			113,000,000			470	U	200	U	58	JQ	440	U	480	U	230	U
Fluoranthene	2,300,000			36,000,000	29,000	Soil Invertebrates	9.1	U	38		24		16		140		130	
Fluorene	2,300,000			36,000,000	29,000	Soil Invertebrates	9.1	U	3.9	JQ	5	U	4.3	U	15		18	
Indeno(1,2,3-cd)pyrene	150		1,360		1,100	Mammalian	9.1	U	15		5	U	4.9		24		22	
Naphthalene	3,900	5,000	400,000	8,870,000	29,000	Soil Invertebrates	9.1	U	2.8	JQ	7.0		4.3	U	10		8.2	
Pentachlorophenol	3,000		29,900	14,800,000	2,100	Avian	18	U	7.8	U	10	U	4.4	JQ	15		13	
Phenanthrene					29,000	Soil Invertebrates	9.1	U	9.0		17		4	JQ	76		65	
Pyrene				27,000,000	1,100	Mammalian	9.1	U	37		22		17		130		91	

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/kg = Micrograms per kilogram
CLP Sample ID = Contract Laboratory Program sample identification number
Eco SSL = Ecological Soil Screening Level
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
mg/kg = Milligrams per kilogram
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SS = Surface Soil
U = Analyte was not detected above the level of the associated value.
WB = Warmhouse Beach
WBB = Warmhouse Beach Background

Table 7
Organic Analytical Results Summary - Surface Soil Samples - Pesticides and PCBs
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID							JC658		JC651		JC652		JC653		JC655		JC656	
Location ID							WBB-06-SS		WB-14-SS		WB-15-SS		WB-16-SS		WB-17-SS		WB-18-SS	
Sample Date							1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location							Background		Waste Pile									
	Human Health				Ecological													
	RSL-RS	MTCA-A	PRG-Carc	PRG-Noncarc	Eco SSL	Eco SSL Species												
Pesticide and PCB (µg/kg)																		
4,4'-DDD	2,000		34,700	2,270,000			9.4	U	4.2	U	0.37	JQ	4.4	U	4.8	U	4.2	U
4,4'-DDT	1,700	3,000	64,300	1,450,000	21	Mammalian	9.4	U	4.2	JK	5.2	U	4.4	U	4.8	U	4.2	U
Aldrin	29		491	34,000			4.7	U	0.53	JQ	2.6	U	2.2	U	2.4	U	0.091	JQ
alpha-BHC	77		1,320				4.7	U	2	U	2.6	U	0.72	JQ	2.9		1.4	JQ
alpha-Chlordane	1,600						4.7	U	35		2.6	U	2.2	U	2.4	U	2.1	U
Aroclor - 1016	3,900		88,000	58,900			92	U	38	U	17	JQ	42	U	12	JQ	42	U
Aroclor - 1254	220		3,080	16,800			92	U	38	U	49	U	12	JQ	28	JQ	41	JQ
Endosulfan I							4.7	U	2	U	2.4	JQ	2.2	U	0.45	JQ	0.25	JQ
Endosulfan II							9.4	U	4.2	U	0.43	JQ	4.4	U	0.76	JQ	4.2	U
Endosulfan sulfate							9.4	U	0.16	JQ	5.2	U	4.4	U	4.8	U	0.061	JQ
Endrin	18,000			340,000			9.1	U	2.1	JQ	5.2	U	4.4	U	0.42	JQ	4.2	U
Endrin ketone							0.076	JQ	0.037	JQ	5.2	U	4.4	U	4.8	U	4.2	U
gamma-Chlordane	1,600						4.7	U	39		1.8	JQ	2.2	U	2.4	U	2.1	U
Heptachlor	110		1,850	567,000			4.7	U	9.8		2.6	U	2.2	U	2.4	U	2.1	U

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/kg = Micrograms per kilogram
CLP Sample ID = Contract Laboratory Program sample identification number
Eco SSL = Ecological Soil Screening Level
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
mg/kg = Milligrams per kilogram
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SS = Surface Soil
U = Analyte was not detected above the level of the associated value.
WB = Warmhouse Beach
WBB = Warmhouse Beach Background

Table 8
Inorganic Analytical Results Summary - Sediment Samples - West Creek
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID						MJC657		MJC667		MJC668		MJC669		MJC670		MJC671		MJC672	
Location ID						WBB-06-SD		WBW-01-SD		WBW-02-SD		WBW-03-SD		WBW-04-SD		WBW-05-SD		WBW-07-SD	
Sample Date						1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010	
Location						Background		West Creek											
	Human Health				Ecological														
	RSL-RS	MTCA-A	PRG-Carc	PRG-Noncarc	SQS														
Inorganic Compounds (mg/kg)																			
Antimony	31			3,500		13	UJL	8.1	JL	3.9	JL	9.3	UJL	10.2	UJL	13.8	UJL	9.4	UJL
Arsenic	0.39	20 (inorganic)	14.6	871	57	**4.7**		**13.4**		**11.3**		**6.1**		**8.9**		**4.6**		**4.2**	
Barium	15,000			1,710,000		77.8		701		316		105		83.4		91.2		98	
Beryllium	160		16.7	17,400		0.62	JQ	0.68	JQ	0.79	JQ	0.61	JQ	0.61	JQ	0.35	JQ	0.49	JQ
Cadmium	70	2	206,000	2,370	5.1	1.1	U	**6**		**2.7**		0.25	JQ	0.85	U	1.2	U	0.18	JQ
Chromium	280	2,000	30,900		260	46	JL	32.6	JL	34.1	JL	60.9	JL	64	JL	30.1	JL	60.4	JL
Cobalt	23		41,200	2,620		8	JQ	**68.7**		**47.2**		16.5		17.6		10	JQ	16.4	
Copper	3,100			350,000	390	36.7		111		78		36.2		62.4		35.6		53	
Lead	400	250	8,440		450	8.1	JL	50.5	JL	38	JL	8.2	JL	9.2	JL	8.2	JL	8	JL
Manganese	1,800			205,000		188	JL	**26,500**	JL	**10,000**	JL	508	JL	304	JL	752	JL	550	JL
Mercury	23	2		2,630	0.41	0.13	JQ	**0.48**	JQ	0.5	U	0.1	JQ	0.17	U	0.14	JQ	0.16	U
Nickel	1,500		1,420,000	171,000		23.9		129		88		47.3		43.1		32.6		40.9	
Selenium	390			43,800		1.5	JQ	19.8	U	17.6	U	5.4	U	5.9	U	1.1	JQ	5.5	U
Silver	390			43,800	6.1	0.34	JQ	1.6	JQ	0.74	JQ	1.6	U	0.14	JQ	0.17	JQ	1.6	U
Thallium	5.1			568		1.8	JQ	**6.3**	JQ	3.9	JQ	**5.2**		4.9		1.5	JQ	4.8	
Vanadium	390			44,200		86.1	JL	62.3	JL	65.9	JL	102	JL	121	JL	55.1	JL	93.4	JL
Zinc	23,000			2,630,000	410	62.6	JL	**2,610**	JL	**1,200**	JL	153	JL	80.3	JL	160	JL	141	JL

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
CLP Sample ID = Contract Laboratory Program sample identification number
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
mg/kg = milligrams per kilogram
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SD = Sediment
SQS= Washington State Sediment Quality Standards "no effects" level
U = Analyte was not detected above the level of the associated value.
WBB = Warmhouse Beach Background
WBW = Warmhouse Beach West Creek

Table 9
Inorganic Analytical Results Summary - Surface Water Samples - West Creek
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID							MJC621		MJC628		MJC629		MJC630		MJC631		MJC632		MJC633	
Location ID							WBB-06-SW		WBW-01-SW		WBW-02-SW		WBW-03-SW		WBW-04-SW		WBW-05-SW		WBW-07-SW	
Sample Date							1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010	
Location							Background		West Creek											
	Human Health				Ecological															
	MCL	RSL-TW	WQC-HH	MT-HH	WQC-FC	TSC-FC														
Inorganic Compounds (µg/L)																				
Arsenic	10	0.045	0.018	0.0048			1	U	**1.5**		**1.3**		**1.4**		**1.1**		**1.1**		**1.4**	
Barium	2,000	7,300					2.1	JQ	51.7		49.7		55.1		68.9		67.6		56.3	
Cadmium	5	18					1	U	0.088	JQ	1	U	0.069	JQ	1	U	1	U	0.084	JQ
Chromium	100						0.22	U	0.62	JQ	1	JQ	0.91	JQ	0.39	U	1.2	JQ	0.85	JQ
Cobalt		11					1	U	0.63	JQ	0.38	JQ	0.87	JQ	0.33	JQ	0.8	JQ	0.83	JQ
Copper	1,300	1,500	1,300	1,300			0.23	JQ	2.6		1.5	JQ	2.2		1	JQ	2	JQ	1.9	JQ
Lead	15						1	U	1.2		0.31	JQ	0.69	JQ	1	U	0.57	JQ	0.62	JQ
Manganese		880					2.4	JL	178	JL	34.6	JL	98.6	JL	19.8	JL	62.9	JL	89.4	JL
Nickel		730	610	160			0.18	JQ	4.8		4.4		4.4		4.9		5.2		4.6	
Selenium	50	180	170	130	5	5	5	U	**5.4**		**5.2**		4.7	JQ	4.3	JQ	4.1	JQ	**5.2**	
Vanadium		180					0.28	JQ	0.89	JQ	0.34	JQ	1.6	JQ	0.5	JQ	1.9	JQ	1.5	JQ
Zinc		11,000	7,400	2,400			2	UJK	50.8	JK	28.2	JK	31.1	JK	14.1	JK	22.8	JK	30.4	JK

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/L = Micrograms per liter
CLP Sample ID = Contract Laboratory Program sample identification number
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
MCL = Maximum Contaminant Level (Drinking Water)
MT-HH = Makah Tribe Water Quality Standards - Human Health - Water + Organism
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-TW = Regional Screening Level - Tap Water
SW = Surface Water
TSC-FC = State of Washington Toxic Substances Criteria - Freshwater Chronic
U = Analyte was not detected above the level of the associated value.
WBB = Warmhouse Beach Background
WBW = Warmhouse Beach West Creek
WQC-FC = Federal Water Quality Criteria - Freshwater Continuous Chronic Criteria
WQC-HH = Federal Water Quality Criteria - Human Health - Water + Organism

Table 10
Inorganic Analytical Results Summary - Filtered Surface Water Samples - West Creek
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID			MJC638		MJC645		MJC646		MJC647		MJC648		MJC649		MJC650	
Location ID			WBB-06-SW		WBW-01-SW		WBW-02-SW		WBW-03-SW		WBW-04-SW		WBW-05-SW		WBW-07-SW	
Sample Date			1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010	
Location			Background		West Creek											
	WQC-FC	TSC-FC														
Inorganic Compounds (µg/L)																
Arsenic	150	190	0.08	JQ	1.3		1.2		1.1		1		0.98	JQ	1.2	
Barium			14.5		47.7		50.2		50.9		64.7		63.7		50	
Cobalt			1	U	0.34	JQ	0.25	JQ	0.21	JQ	0.19	JQ	0.18	JQ	0.2	JQ
Copper	HD*	HD	0.93	JQ	1.6	JQ	1.4	JQ	3.4		1.3	JQ	1.1	JQ	4.8	
Manganese			2.6		114		14.7		2.1		2.4		1.2		2.2	
Nickel	HD	HD	0.8	JQ	4.3		4.0		3.3		4.4		3.5		3.4	
Selenium			0.41	U	5.2		5.0		4.8	JQ	4.4	JQ	4.2	JQ	4.7	JQ
Vanadium			0.32	JQ	5	U	0.1	JQ	0.081	JQ	0.14	JQ	0.2	JQ	0.1	JQ
Zinc	HD	HD	4.0	JH	35.4		21.4	JH	14	JH	12.6	JH	9.3	JH	16.2	JH

* The WQC-FC for copper should be calculated using the biotic ligand model (BLM). However, insufficient information was available to calculate the WQC-FC based on the BLM, therefore, the WQC-FC for copper was calculated based on hardness according to Appendix B of the National Recommended Water Quality Criteria.

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/L = Micrograms per liter
CLP Sample ID = Contract Laboratory Program sample identification number
H = High bias
J = The analyte was positively identified. The associated numerical result is an estimate.
Location ID = START-3 sample identification number
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
SW = Surface Water
TSC-FC = State of Washington Toxic Substances Criteria - Freshwater Chronic
U = Analyte was not detected above the level of the associated value.
WBB = Warmhouse Beach Background
WBW = Warmhouse Beach West Creek
WQC-FC = Federal Water Quality Criteria - Freshwater Continuous Chronic Criteria

Hardness Dependent Screening Level for WQC-FW (µg/L)

Analyte	WBB-06-SW		WBW-01-SW	WBW-02-SW	WBW-03-SW	WBW-04-SW	WBW-05-SW	WBW-07-SW
Hardness (mg/L)	12.0	JQ	242	208	184	138	133	184
Cadmium	0.06		0.45	0.41	0.38	0.31	0.30	0.38
Copper	1.46		19.1	16.7	15.1	11.8	11.4	15.1
Lead	0.24		6.49	5.53	4.85	3.57	3.43	4.85
Nickel	8.65		110	97	87	68	66	87
Zinc	19.6		250	220	198	155	150	198

Hardness Dependent Screening Level for TSC-FC (µg/L)

Analyte	WBB-06-SW		WBW-01-SW	WBW-02-SW	WBW-03-SW	WBW-04-SW	WBW-05-SW	WBW-07-SW
Hardness (mg/L)	12.0	JQ	242	208	184	138	133	184
Cadmium	0.21		1.98	1.77	1.62	1.31	1.27	1.62
Copper	1.85		24.2	21.2	19.1	14.9	14.5	19.1
Lead	0.24		6.49	5.53	4.85	3.57	3.43	4.85
Nickel	26.1		332	292	263	206	200	263
Zinc	17.3		221	194	175	137	133	175

Table 11
Inorganic Analytical Results Summary - Sediment Samples - East Creek
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID						MJC659		MJC660		MJC662		MJC663		MJC665		MJC666	
Location ID						WBB-13-SD		WBE-08-SD		WBE-09-SD		WBE-10-SD		WBE-11-SD		WBE-12-SD	
Sample Date						1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location						Background		East Creek									
	Human Health				Ecological												
	RSL-RS	MTCA-A	PRG-Carc	PRG-Noncarc	SQS												
Inorganic Compounds (mg/kg)																	
Arsenic	0.39	20 (inorganic)	14.6	871	57	**5.1**		**4.1**		**2.3**		**2.3**		**4.8**		**2.5**	
Barium	15,000			1,710,000		113		45.3		50.2		38.2		71.1		65.5	
Beryllium	160		16.7	17,400		0.64	JQ	0.26	U	0.24	U	0.22	U	1.5	U	0.94	U
Cadmium	70	2	206,000	2,370	5.1	1.3	U	0.2	JQ	0.68	JQ	0.46	JQ	0.94	JQ	1.2	
Chromium	280	2,000	30,900		260	47.4	JL	34.8	JL	19.4	JL	18	JL	28.7	JL	19.7	JL
Cobalt	23		41,200	2,620		14.3		6	JQ	7.6	JQ	7.4		10.3	JQ	8.6	JQ
Copper	3,100			350,000	390	35.7		23		18.3		13.2		28.3		22.2	
Lead	400	250	8,440		450	8.8	JL	14.5	JL	12.1	JL	8.4	JL	20.9	JL	16.5	JL
Manganese	1,800			205,000		837	JL	377	JL	927	JL	771	JL	1,270	JL	1,060	JL
Mercury	23	2		2,630	0.41	0.15	JQ	0.12	JQ	0.088	JQ	0.14	U	0.14	JQ	0.19	U
Nickel	1,500		1,420,000	171,000		32.7		18.9		23.8		21.9		28.5		29.6	
Silver	390			43,800	6.1	0.19	JQ	1.8	U	0.093	JQ	1.3	U	0.14	JQ	0.13	JQ
Thallium	5.1			568		2.1	JQ	2.1	JQ	1.3	JQ	1.7	JQ	1.6	JQ	1	JQ
Vanadium	390			44,200		78.2	JL	68.8	JL	36.6	JL	38.7	JL	53.2	JL	37.8	JL
Zinc	23,000			2,630,000	410	81.8	JL	179	JL	345	JL	343	JL	**425**	JL	**477**	JL

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
CLP Sample ID = Contract Laboratory Program sample identification number
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
mg/kg = milligrams per kilogram
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SD = Sediment
SQS= Washington State Sediment Quality Standards "no effects" level
U = Analyte was not detected above the level of the associated value.
WBB = Warmhouse Beach Background
WBE = Warmhouse Beach East Creek

Table 12
Inorganic Analytical Results Summary - Surface Water Samples - East Creek
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID							MJC622		MJC623		MJC624		MJC625		MJC626		MJC627	
Location ID							WBB-13-SW		WBE-08-SW		WBE-09-SW		WBE-10-SW		WBE-11-SW		WBE-12-SW	
Sample Date							1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location							Background		East Creek									
	Human Health				Ecological													
	MCL	RSL-TW	WQC-HH	MT-HH	WQC-FC	TSC-FC												
Inorganic Compounds (µg/L)																		
Arsenic	10	0.045	0.018	0.0048			**0.28**	JQ	**1.4**		**1.1**		**1**		**1**		**1.1**	
Barium	2,000	7,300					14.8		87		50.7		45.9		45.9		48	
Cadmium	5	18					1	U	1.1		0.13	JQ	0.11	JQ	0.081	JQ	0.14	JQ
Cobalt		11					0.47	JQ	1.2		0.29	JQ	0.22	JQ	0.2	JQ	0.26	JQ
Copper	1,300	1,500	1,300	1,300			1.9	JQ	4.6		2.2		1.8	JQ	1.7	JQ	2.2	
Lead	15						0.53	JQ	2.5		1.1		0.82	JQ	0.61	JQ	0.95	JQ
Manganese		880					29.3	JL	519	JL	29.1	JL	20.7	JL	15.4	JL	25.9	JL
Nickel		730	610	160			1.3		14.6		4.1		3.5		3.4		3.9	
Selenium	50	180	170	130	5	5	0.4	U	**5.2**		4.4	JQ	4	JQ	4.1	JQ	4.4	JQ
Vanadium		180					2.9	JQ	1.3	JQ	0.92	JQ	0.68	JQ	0.59	JQ	0.78	JQ
Zinc		11,000	7,400	2,400			4.3	JK	282	JK	71.7	JK	63	JK	55.7	JK	68.8	JK

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/L = Micrograms per liter
CLP Sample ID = Contract Laboratory Program sample identification number
ID = Identification
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
MCL = Maximum Contaminant Level (Drinking Water)
MT-HH = Makah Tribe Water Quality Standards - Human Health - Water + Organism
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-TW = Regional Screening Level - Tap Water
SW = Surface Water
TSC-FC = Washington State Toxic Substances Criteria - Freshwater Chronic
U = Analyte was not detected above the level of the associated value.
WBB = Warmhouse Beach Background
WBE = Warmhouse Beach East Creek
WQC-FC = Water Quality Criteria - Freshwater Criterion Continuous Concentration
WQC-HH = Water Quality Criteria - Human Health - Water + Organism

Table 13
Inorganic Analytical Results Summary - Filtered Surface Water Samples - East Creek
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID			MJC639		MJC640		MJC641		MJC642		MJC643		MJC644	
Location ID			WBB-13-SW		WBE-08-SW		WBE-09-SW		WBE-10-SW		WBE-11-SW		WBE-12-SW	
Sample Date			1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location			Background		East Creek									
	WQC-FC	TSC-FC												
Inorganic Compounds (µg/L)														
Arsenic	150	190	0.12	JQ	1.4		1.1		1		1.1		0.99	JQ
Barium			9.5	JQ	64.2		49.6		46.2		44.7		46.2	
Cadmium	HD	HD	1	U	0.18	JQ	0.097	JQ	0.083	JQ	0.074	JQ	0.084	JQ
Cobalt			1	U	0.18	JQ	0.11	JQ	0.12	JQ	0.097	JQ	0.11	JQ
Copper	HD*	HD	**3.4**		1.9	JQ	1.4	JQ	1.4	JQ	1.3	JQ	1.3	JQ
Manganese			5.8		21.6		3.9		1.5		1.1		3.6	
Nickel	HD	HD	0.51	JQ	4.8		3.3		3.1		2.9		3.1	
Selenium			0.31	U	5.8		4.4	JQ	4.1	JQ	4.3	JQ	4	JQ
Vanadium			0.59	JQ	0.14	JQ	0.22	JQ	0.22	JQ	0.21	JQ	0.19	JQ
Zinc	HD	HD	3.7	JH	90.3		58		47.9		43.5		53	

* The WQC-FC for copper should be calculated using the biotic ligand model (BLM). However, insufficient information was available to calculate the WQC-FC based on the BLM, therefore, the WQC-FC for copper was calculated based on hardness according to Appendix B of the National Recommended Water Quality Criteria.

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/L = Micrograms per liter
CLP Sample ID = Contract Laboratory Program sample identification number
H = High bias
HD = Hardness Dependent, see table below
J = The analyte was positively identified. The associated numerical result is an estimate.
Location ID = START-3 sample identification number
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
SW = Surface Water
TSC-FC = State of Washington Toxic Substances Criteria - Freshwater Chronic
U = Analyte was not detected above the level of the associated value.
WBB = Warmhouse Beach Background
WBE = Warmhouse Beach East Creek
WQC-FC = Federal Water Quality Criteria - Freshwater Criterion Continuous Concentration

Hardness Dependent Screening Level for WQC-FW (µg/L)

Analyte	WBB-13-SW		WBE-08-SW	WBE-09-SW	WBE-10-SW	WBE-11-SW	WBE-12-SW
Hardness (mg/L)	9.44	JQ	178	141	134	130	141
Cadmium	0.05		0.37	0.31	0.30	0.30	0.31
Copper	1.19		14.7	12.0	11.5	11.2	12.0
Lead	0.18		4.69	3.65	3.46	3.34	3.65
Nickel	7.06		85	70	67	65	70
Zinc	16.0		193	158	151	148	158

Hardness Dependent Screening Level for TSC-FC (µg/L)

Analyte	WBB-13-SW	WBE-08-SW	WBE-09-SW	WBE-10-SW	WBE-11-SW	WBE-12-SW
Cadmium	0.18	1.58	1.33	1.28	1.25	1.33
Copper	1.51	18.6	15.2	14.6	14.2	15.2
Lead	0.18	4.69	3.65	3.46	3.34	3.65
Nickel	21.3	256	210	201	196	210
Zinc	14.1	170	140	134	131	140

Table 14
Inorganic Analytical Results Summary - Surface Soil Samples
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID							MJC658		MJC651		MJC652		MJC653		MJC655		MJC656	
Location ID							WBB-06-SS		WB-14-SS		WB-15-SS		WB-16-SS		WB-17-SS		WB-18-SS	
Sample Date							1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location							Background		Waste Pile									
	Human Health				Ecological													
	RSL-RS	MTCA-A	PRG-Carc	PRG-Noncarc	Eco SSL	Eco SSL Species												
Inorganic Compounds (mg/kg)																		
Antimony	31			3,500	0.27	Mammalian	15.1	UJL	6.8	UJL	**33.7**	JL	**1.2**	JL	**0.99**	JL	**1.0**	JL
Arsenic	0.39	20 (inorganic)	14.6	871	18	Plants	**8.0**		**9.6**		**6.9**		**7.2**		**8.3**		**6.1**	
Barium	15,000			1,710,000	330	Soil Invertebrates	30.9	JQ	81.1		178		70.1		112		81.4	
Beryllium	160		16.7	17,400	21	Mammalian	0.42	JQ	0.4	JQ	0.22	U	0.42	JQ	0.34	U	0.27	U
Cadmium	70	2	206,000	2,370	0.36	Mammalian	1.3	U	0.26	JQ	**10.8**		**0.54**	JQ	**0.75**		**0.62**	
Chromium	280	2,000	30,900		26	Cr(III) Avian	**31.9**	JL	**36.4**	JL	**35**	JL	**44.5**	JL	**35.7**	JL	**27.5**	JL
Cobalt	23		41,200	2,620	13	Plants	6.1	JQ	**13.1**		10.8		**15.3**		**13.4**		10.4	
Copper	3,100			350,000	28	Avian	**30.2**		**69.7**		**520**		**83**		**182**		**140**	
Lead	400	250	8,440		11	Avian	10.6	JL	**23.5**	JL	**127**	JL	**58.9**	JL	**137**	JL	**104**	JL
Manganese	1,800			205,000	220	Plants	**274**	JL	**954**	JL	**540**	JL	**575**	JL	**481**	JL	**346**	JL
Mercury	23	2		2,630			0.26		0.12	U	0.095	JQ	0.27		0.15		0.12	JQ
Nickel	1,500		1,420,000	171,000	38	Plants	14.1		35.8		**40.7**		31		32.7		24	
Silver	390			43,800	4.2	Avian	0.27	JQ	0.17	JQ	2.0		0.074	JQ	0.11	JQ	0.12	JQ
Thallium	5.1			568			3.4	JQ	4.5		3.3		4.5		4.3		3.1	
Vanadium	390			44,200	7.8	Avian	**78.3**	JL	**73**	JL	**35.5**	JL	**83.8**	JL	**74.2**	JL	**52.3**	JL
Zinc	23,000			2,630,000	46	Avian	39.2	JL	**80.7**	JL	**923**	JL	**165**	JL	**375**	JL	**262**	JL

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
CLP Sample ID = Contract Laboratory Program sample identification number
Eco SSL = Ecological Soil Screening Level
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
mg/kg = Milligrams per kilogram
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SS = Surface Soil
U = Analyte was not detected above the level of the associated value.
WB = Warmhouse Beach
WBB = Warmhouse Beach Background

Table 15
Total Petroleum Hydrocarbons Analytical Results Summary - Sediment Samples
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID	Location ID	Sample Date	Action Level	Diesel Range Organics		Motor Oil Range		Unleaded Gasoline Composite	
			RSL-RS						
			MTCA-A	2000				30 (benzene)	
			PRG-Carc						
			PRG-Noncarc						
			Location						
West Creek (mg/kg)									
JC657	WBB-06-SD	1/26/10	Background	7.8	U	16	U	7	U
JC667	WBW-01-SD	1/26/10	West Creek	16	U	33	U	18	U
JC668	WBW-02-SD	1/26/10		16	U	32	U	20	U
JC669	WBW-03-SD	1/26/10		5.1	U	10	U	5.4	U
JC670	WBW-04-SD	1/26/10		6.1	U	12	U	6.4	U
JC671	WBW-05-SD	1/26/10		8.3	U	17	U	7.7	U
JC672	WBW-07-SD	1/26/10		5.2	U	10	U	5.2	U
East Creek (mg/kg)									
JC659	WBB-13-SD	1/26/10	Background	7.1	U	14	U	9.1	U
JC660	WBE-08-SD	1/27/10	East Creek	6	U	12	U	6.8	U
JC662	WBE-09-SD	1/27/10		6.3	U	13	U	4.6	U
JC663	WBE-10-SD	1/27/10		3.6	U	7.2	U	4.2	U
JC665	WBE-11-SD	1/27/10		8	U	16	U	9.1	U
JC666	WBE-12-SD	1/27/10		5.1	U	10	U	5.1	U

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
CLP Sample ID = Contract Laboratory Program sample identification number
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
mg/kg = Milligrams per kilogram
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SD = Sediment
U = Analyte was not detected above the level of the associated value.
WBB = Warmhouse Beach Background
WBE = Warmhouse Beach East Creek
WBW = Warmhouse Beach West Creek

Table 16
Total Petroleum Hydrocarbons Analytical Results Summary - Surface Water Samples
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

			Action Level	Diesel Range Organics		Motor Oil Range		Unleaded Gasoline Composite	
			MCL						
			RSL-TW						
			WQC-HH						
CLP Sample ID	Location ID	Sample Date	Location						
West Creek (mg/L)									
JC621	WBB-06-SW	1/26/2010	Background	0.094	U	0.19	U	50	U
JC628	WBW-01-SW	1/26/2010	West Creek	0.094	U	0.19	U	50	U
JC629	WBW-02-SW	1/26/2010		0.098	U	0.20	U	50	U
JC630	WBW-03-SW	1/26/2010		0.094	U	0.19	U	50	U
JC631	WBW-04-SW	1/26/2010		0.098	U	0.20	U	50	U
JC632	WBW-05-SW	1/26/2010		0.096	U	0.19	U	50	U
JC633	WBW-07-SW	1/26/2010		0.094	U	0.19	U	50	U
East Creek (mg/L)									
JC622	WBB-13-SW	1/26/2010	Background	0.094	U	0.19	U	50	U
JC623	WBE-08-SW	1/27/2010	East Creek	0.094	U	0.19	U	50	U
JC624	WBE-09-SW	1/27/2010		0.094	U	0.19	U	50	U
JC625	WBE-10-SW	1/27/2010		0.094	U	0.19	U	50	U
JC626	WBE-11-SW	1/27/2010		0.094	U	0.19	U	50	U
JC627	WBE-12-SW	1/27/2010		0.094	U	0.19	U	50	U

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
CLP Sample ID = Contract Laboratory Program sample identification number
ID = Identification
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
MCL = Maximum Contaminant Level (Drinking Water)
mg/L = milligrams per liter
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-TW = Regional Screening Level - Tap Water
SW = Surface Water
U = Analyte was not detected above the level of the associated value.
WBB = Warmhouse Beach Background
WBE = Warmhouse Beach East Creek
WBW = Warmhouse Beach West Creek
WQC-HH = Federal Water Quality Criteria - Human Health - Water + Organism

Table 17
Total Petroleum Hydrocarbons Analytical Results Summary - Surface Soil Samples
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID					JC658		JC651		JC652		JC653		JC655		JC656	
Location ID					WBB-06-SS		WB-14-SS		WB-15-SS		WB-16-SS		WB-17-SS		WB-18-SS	
Sample Date					1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location					Background		Waste Pile									
	RSL-RS	**MTCA-A**	**PRG-Carc**	**PRG-Noncarc**												
Total Petroluem Hydrocarbons (mg/kg)																
Diesel Range Organics		2,000			9	U	73		3.8	U	24	U	26	U	19	U
Motor Oil Range					18	U	48		270		520		1,300		490	
Unleaded Gasoline Composite		30 (benzene)			10	U	4.7	U	6.4	U	6.6	U	9.2		7.4	

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
CLP Sample ID = Contract Laboratory Program sample identification number
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
mg/kg = Milligrams per kilogram
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SS = Surface Soil
U = Analyte was not detected above the level of the associated value.
WB = Warmhouse Beach
WBB = Warmhouse Beach Background

Table 18
Perchlorate Analytical Results Summary - Sediment Samples
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

			RSL-RS	55,000	
			MTCA-A		
			PRG-Carc		
			PRG-Noncarc	6,130,000	
CLP Sample ID	Location ID	Sample Date	Location		
West Creek (µg/kg)					
JC657	WBB-06-SD	1/26/2010	Background	2.1	U
JC667	WBW-01-SD	1/26/2010	West Creek	5.6	U
JC668	WBW-02-SD	1/26/2010		5.2	U
JC669	WBW-03-SD	1/26/2010		13.6	
JC670	WBW-04-SD	1/26/2010		5.61	
JC671	WBW-05-SD	1/26/2010		2.6	U
JC672	WBW-07-SD	1/26/2010		13.9	
East Creek (µg/kg)					
JC659	WBB-13-SD	1/26/2010	Background	2.3	U
JC660	WBE-08-SD	1/27/2010	East Creek	1.8	U
JC662	WBE-09-SD	1/27/2010		1.7	U
JC663	WBE-10-SD	1/27/2010		1.4	U
JC665	WBE-11-SD	1/27/2010		2.8	U
JC666	WBE-12-SD	1/27/2010		1.6	U

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
CLP Sample ID = Contract Laboratory Program sample identification number
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
mg/kg = Milligrams per kilogram
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit
RSL-RS = Regional Screening Level - Residential Soil
SD = Sediment
U = Analyte was not detected above the level of the associated value.
WBB = Warmhouse Beach Background
WBE = Warmhouse Beach East Creek
WBW = Warmhouse Beach West Creek

Table 19
Perchlorate Analytical Results Summary - Surface Water Samples
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID	Location ID	Sample Date	EPA-HAL / RSL-TW / Location	15 / 26 /	
West Creek (µg/L)					
JC621	WBB-06-SW	1/26/2010	Background	0.1	U
JC628	WBW-01-SW	1/26/2010	West Creek	**52.9**	
JC629	WBW-02-SW	1/26/2010		**44.1**	
JC630	WBW-03-SW	1/26/2010		**42.1**	
JC631	WBW-04-SW	1/26/2010		**26.6**	
JC632	WBW-05-SW	1/26/2010		**24.7**	
JC633	WBW-07-SW	1/26/2010		**41.0**	
East Creek (µg/L)					
JC622	WBB-13-SW	1/26/2010	Background	0.1	U
JC623	WBE-08-SW	1/27/2010	East Creek	2.93	
JC624	WBE-09-SW	1/27/2010		2.06	
JC625	WBE-10-SW	1/27/2010		1.96	
JC626	WBE-11-SW	1/27/2010		1.92	
JC627	WBE-12-SW	1/27/2010		2.04	

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/L = Micrograms per liter
CLP Sample ID = Contract Laboratory Program sample identification number
EPA-HAL = EPA Office of Water Interim Drinking Water Health Advisory Level
Location ID = START-3 sample identification number
RSL-TW = Regional Screening Level - Tap Water
SW = Surface Water
U = Analyte was not detected above the level of the associated value
WBB = Warmhouse Beach Background
WBE = Warmhouse Beach East Creek
WBW = Warmhouse Beach West Creek

Table 20
Perchlorate Analytical Results Summary - Surface Soil Samples
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID	Location ID	Sample Date	RSL-RS / PRG-Noncarc / Location	55,000 / 6,130,000 /	
Open Dump (µg/kg)					
JC658	WBB-06-SS	1/26/2010	Background	2.6	U
JC651	WB-14-SS	1/27/2010	West Creek	1.2	U
JC652	WB-15-SS	1/27/2010		1.4	U
JC653	WB-16-SS	1/27/2010		1.4	U
JC655	WB-17-SS	1/27/2010		1.9	U
JC656	WB-18-SS	1/27/2010		1.4	U

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
CLP Sample ID = Contract Laboratory Program sample identification number
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
mg/kg = Milligrams per kilogram
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SS = Surface Soil
U = Analyte was not detected above the level of the associated value.
WB = Warmhouse Beach
WBB = Warmhouse Beach Background

Table 21
Synthetic Precipitation Leaching Procedure Analytical Results Summary
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID							JC6A1/6 MJC651		JC6A2/7 MJC652		JC6A3/8 MJC653		JC6A4/BO MJC655	
Location ID							WB-14-SS		WB-15-SS		WB-16-SS		WB-17-SS	
Sample Date							1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location							Waste Pile							
	Human Health				**Ecological**									
	MCL	**RSL-TW**	**WQC-HH**	**MT-HH**	**WQC-FC**	**TSC-FC**								
Volatile Organic Compounds (µg/L)														
2-Butanone		7,100					5	U	5	U	5	U	2.5	JQ
Benzene	5	0.41	2.2	1.7			0.5	U	0.31	JQ	0.5	U	0.17	JQ
Ethylbenzene	700	1.5	530	190			0.11	JQ	0.5	U	0.5	U	0.14	JQ
m,p-Xylene		1,400					0.33	JQ	0.5	U	0.5	U	0.4	JQ
o-Xylene		1,400					0.37	JQ	0.5	U	0.5	U	0.21	JQ
Toluene	1,000	2,300	1,300	800			0.079	JQ	0.065	JQ	0.5	U	0.44	JQ
Trichlorofluoromethane		1,300					0.5	U	0.5	U	0.5	U	0.11	JQ
Semivolatile Organic Compounds (µg/L)														
Bis(2-ethylhexyl)phthalate	6	4.8	1.2	0.24			**1.1**	JQ	**2.1**	JQ	**0.81**	JQ	**0.59**	JQ
Fluorene		1,500	1,100	450			0.1	U	0.1	UJK	0.1	U	0.13	
Inorganic Compounds (µg/L)														
Antimony	6	15	5.6	5.2			1.2		**20.3**		2.7		**10.2**	
Arsenic	10	0.045	0.018	0.0048	150	190	0.63	U	0.63	U	0.63	U	**0.9**	
Barium	2,000	7,300					17	J	29	J	20	J	38	J
Chromium	100				11 (Cr(VI))	10 (Cr(VI))	1.3	U	1.3	U	1.4		1.3	U
Copper	1,300	1,500	1,300	1,300	9 (MT-FC)*	HD	2.7		**15.3**		8.44		4.7	
Lead	15				2.5	HD	1.3		1.7		**3.5**		**3.7**	
Nickel		730	610	160	52	HD	1.2		1.7		1.2		1.8	
Zinc		11,000	7,400	2,400	120	HD	22	J	22	J	33	J	23	J

* The WQC-FC for copper should be calculated using the biotic ligand model (BLM). However, insufficient information was available to calculate the WQC-FC based on the BLM or using hardness, therefore, the MT-FC for copper was used.

Key:

Bold = Concentration exceeds action level
Underlined = Concentration elevated when compared to background
µg/L = Micrograms per liter
CLP Sample ID = Contract Laboratory Program sample identification number
HD = Hardness dependent
J = The analyte was positively identified. The associated numerical result is an estimate.
K = Unknown bias
Location ID = START-3 sample identification number
MCL = Maximum Contaminant Level (Drinking Water)
MT-FC = Makah Tribe Water Quality Standards - Freshwater Criterion Continuous Concentration
MT-HH = Makah Tribe Water Quality Standards - Human Health - Water + Organism
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-TW = Regional Screening Level - Tap Water
SS = Surface Soil
TSC-FC = Toxic Substances Criteria - Freshwater Chronic
U = Analyte was not detected above the level of the associated value.
WB = Warmhouse Beach
WQC-FC = Water Quality Criteria - Freshwater Criterion Continuous Concentration
WQC-HH = Water Quality Criteria - Human Health - Water + Organism

Table 22
Dioxin Analytical Results Summary - Sediment Samples
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID					MJC667		MJC668		MJC660		MJC662	
Location ID					WBW-01-SD		WBW-02-SD		WBE-08-SD		WBE-09-SD	
Sample Date					1/26/2010		1/26/2010		1/27/2010		1/27/2010	
Location					West Creek				East Creek			
	RSL-RS	**MTCA-A**	**PRG-Carc**	**PRG-Noncarc**								
Dioxin (ng/kg)												
TEQ*					15.8		30.3		1.5		0.982	
2378-TCDD	4.5		168	6,350,000,000	2.24		4.04		0.249	U	0.404	U
2378-TCDF			641		8.32		20.1		1.95		2.18	
12378-PeCDF			12,800		5.61		11.5		1.08	U	0.752	JQ
12378-PeCDD			168		4.3	JQ	8.1		0.556	JQ	0.850	U
23478-PeCDF			128		7.29		16.8		1.03	JQ	1.19	JQ
123478-HxCDF			641		4.3	JQ	11.6		0.767	JQ	0.61	JQ
123678-HxCDF					7.38		11.2		0.553	JQ	0.467	JQ
123478-HxCDD					2.75	JQ	4.89		0.358	JQ	0.268	JQ
123678-HxCDD			1,650,000		8.62		16		0.597	JQ	0.58	JQ
123789-HxCDD					5.28		9.53		0.403	JQ	0.481	JQ
234678-HxCDF			641		5.7		11.1		0.784	JQ	0.599	JQ
123789-HxCDF			637,000		1.56	U	2.75	U	0.211	U	0.137	U
1234678-HpCDF			6,410		24		41.5		2.13	JQ	2.06	JQ
1234678-HpCDD			1,680,000		183		296		6.05		5.28	
1234789-HpCDF			641,000		2.00	U	3.47	JQ	0.306	U	0.279	U
OCDD			1,680,000		1900		2990		43.9		33.6	
OCDF			641,000		31.8		48		2.64	JQ	2.35	JQ

* Agency for Toxic Substances and Disease Registry Screening Level - 50 ng/kg

Key:

Bold = Concentration exceeds action level
CLP Sample ID = Contract Laboratory Program sample identification number
J = The analyte was positively identified. The associated numerical result is an estimate.
Location ID = START-3 sample identification number
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
ng/kg = Nanograms per kilogram
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SD = Sediment
TEQ = Toxic Equivalency
U = Analyte was not detected above the level of the associated value.
WBE = Warmhouse Beach East Creek
WBW = Warmhouse Beach West Creek

Table 23
Dioxin Analytical Results Summary - Surface Soil Samples
Warmhouse Beach Open Dump
Neah Bay, Clallam County, Washington

CLP Sample ID					JC651		JC652		JC653		JC655	
Location ID					WB-14-SS		WB-15-SS		WB-16-SS		WB-17-SS	
Sample Date					1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location					Waste Pile							
	RSL-RS	**MTCA-A**	**PRG-Carc**	**PRG-Noncarc**								
Dioxin (ng/kg)												
TEQ*					4.17	J	**2300**		4.43		**53.7**	
2378-TCDD	4.5		168	6,350,000,000	0.345	JQ	**150**		0.318	U	2.56	
2378-TCDF			641		1.79		386	JL	1.6		19	
12378-PeCDF			12,800		1.6	JQ	574	U	1.11	JQ	16.9	
12378-PeCDD			168		1.1	JQ	**763**		1.33	JQ	12.3	
23478-PeCDF			128		2.51	JQ	**1180**		1.37		29.9	
123478-HxCDF			641		1.92	JQ	1050	U	2.20	JQ	32.8	
123678-HxCDF					2.29	JQ	790		2.34	JQ	30.3	
123478-HxCDD					0.8	JQ	963		1.18	JQ	9.07	
123678-HxCDD			1,650,000		2.18	JQ	2160	JL	4.6		30.5	
123789-HxCDD					1.45	JQ	1530		2.45	JQ	16.5	
234678-HxCDF			641		3.01	JQ	**1450**		3.36	JQ	35.4	
123789-HxCDF			637,000		0.733	JQ	191		0.84		8.41	
1234678-HpCDF			6,410		11.9		4990	JL	21.3		183	
1234678-HpCDD			1,680,000		31.7		10700	JL	82.7		702	
1234789-HpCDF			641,000		0.98	U	167		7.89		18.6	U
OCDD			1,680,000		230		17100	JL	800		7480	JH
OCDF			641,000		15.4		1100		54.4		340	JH

* Agency for Toxic Substances and Disease Registry Screening Level - 50 ng/kg

Key:

Bold = Concentration exceeds action level
CLP Sample ID = Contract Laboratory Program sample identification number
H = High bias
J = The analyte was positively identified. The associated numerical result is an estimate.
L = Low bias
Location ID = START-3 sample identification number
MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels
ng/kg = Nanograms per kilogram
PRG-Carc = Preliminary Remediation Goal - Carcinogen
PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen
Q= Detected concentration is below the method reporting limit/Contract required quanitation limit, but is above the method detection limit.
RSL-RS = Regional Screening Level - Residential Soil
SS = Surface Soil
TEQ = Toxic Equivalency
U = Analyte was not detected above the level of the associated value.
WB = Warmhouse Beach

Table 24

Polybrominated Diphenyl Ether Analytical Results Summary - Sediment Samples from West Creek

Warmhouse Beach Open Dump

Neah Bay, Clallam County, Washington

CLP Sample ID					MJC657		MJC667		MJC668		MJC669		MJC670		MJC671		MJC672	
Location ID					WBB-06-SD		WBW-01-SD		WBW-02-SD		WBW-03-SD		WBW-04-SD		WBW-05-SD		WBW-07-SD	
Sample Date					1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010		1/26/2010	
Location					Background		West Creek											
	RSL-RS	**MTCA-A**	**PRG-Carc**	**PRG-Noncarc**														
PBDE (µg/kg)																		
PBDE# 28					1.1	U	1.1	J	1	J	1.1	U	1.1	U	1.3	U	1.2	U
PBDE# 47	7,800			876,000	1.1	U	48		36		0.19	J	1.1	U	1.4		0.31	J
PBDE# 99	7,800			876,000	1.1	U	160		100		0.38	J	1.1	U	2.3		0.31	J
PBDE#100					1.1	U	33		22		1.1	U	1.1	U	0.67	J	1.2	U
PBDE#153	16,000			1,750,000	1.1	U	18		12		1.1	U	1.1	U	1.3	U	1.2	U
PBDE#154					1.1	U	16		11		1.1	U	1.1	U	1.3	U	1.2	U
PBDE#183					1.1	U	2.6	J	1.7	J	1.1	U	1.1	U	1.3	U	1.2	U
PBDE#209	430,000		11,900,000	7,940,000	11	U	18	J	15	J	11	U	11	U	13	U	12	U

Key:

Bold = Concentration exceeds action level

Underlined = Concentration elevated when compared to background

µg/kg = Micrograms per kilogram

CLP Sample ID = Contract Laboratory Program sample identification number

J = The analyte was positively identified. The associated numerical result is an estimate.

Location ID = START-3 sample identification number

MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels

PBDE = Polybrominated Diphenyl Ether

PRG-Carc = Preliminary Remediation Goal - Carcinogen

PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen

RSL-RS = Regional Screening Level - Residential Soil

SD = Sediment

U = Analyte was not detected above the level of the associated value.

WBB = Warmhouse Beach Background

WBW = Warmhouse Beach West Creek

Table 25

Polybrominated Diphenyl Ether Analytical Results Summary - Sediment Samples from East Creek

Warmhouse Beach Open Dump

Neah Bay, Clallam County, Washington

CLP Sample ID					MJC659		MJC660		MJC662		MJC663		MJC665		MJC666	
Location ID					WBB-13-SD		WBE-08-SD		WBE-09-SD		WBE-10-SD		WBE-11-SD		WBE-12-SD	
Sample Date					1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location					Background		East Creek									
	RSL-RS	**MTCA-A**	**PRG-Carc**	**PRG-Noncarc**												
PBDE (µg/kg)																
PBDE# 47	7,800			876,000	1.2	U	0.59	J	0.74	J	0.59	J	2.9		0.9	J
PBDE# 99	7,800			876,000	1.2	U	0.48	J	0.71	J	0.68	J	2.1		0.78	J
PBDE#100					1.2	U	1.2	U	1.1	U	1.1	U	0.46	J	0.24	J

Key:

Bold = Concentration exceeds action level

Underlined = Concentration elevated when compared to background

µg/kg = Micrograms per kilogram

CLP Sample ID = Contract Laboratory Program sample identification number

J = The analyte was positively identified. The associated numerical result is an estimate.

Location ID = START-3 sample identification number

MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels

PBDE = Polybrominated Diphenyl Ether

PRG-Carc = Preliminary Remediation Goal - Carcinogen

PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen

RSL-RS = Regional Screening Level - Residential Soil

SD = Sediment

U = Analyte was not detected above the level of the associated value.

WBB = Warmhouse Beach Background

WBE = Warmhouse Beach East Creek

Table 26

Polybrominated Diphenyl Ether Analytical Results Summary - Surface Soil Samples

Warmhouse Beach Open Dump

Neah Bay, Clallam County, Washington

CLP Sample ID					MJC658		MJC651		MJC652		MJC653		MJC655		MJC656	
Location ID					WBB-06-SS		WB-14-SS		WB-15-SS		WB-16-SS		WB-17-SS		WB-18-SS	
Sample Date					1/26/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010		1/27/2010	
Location					Background		Waste Pile									
	RSL-RS	**MTCA-A**	**PRG-Carc**	**PRG-Noncarc**												
PBDE (µg/kg)																
PBDE# 28					1.4	U	1	U	0.36	J	0.27	J	0.64	J	0.73	J
PBDE# 47	7,800			876,000	1.4	U	3.5		20		14		29		35	
PBDE# 99	7,800			876,000	1.4	U	6.4		37		37		58		66	
PBDE#100					1.4	U	1.4		7.8		7.2		11		13	
PBDE#153	16,000			1,750,000	1.4	U	0.95	J	5.1		4.7		6.8		7.4	
PBDE#154					1.4	U	0.85	J	4.5		4.0		5.6		6.0	
PBDE#183					1.4	U	1	U	2.3		0.6	J	1.1		1.1	
PBDE#209	430,000		11,900,000	7,940,000	14	U	6.4	J	12	J	18	J	17	J	24	J

Key:

Bold = Concentration exceeds action level

Underlined = Concentration elevated when compared to background

µg/kg = Micrograms per kilogram

CLP Sample ID = Contract Laboratory Program sample identification number

J = The analyte was positively identified. The associated numerical result is an estimate.

Location ID = START-3 sample identification number

MTCA-A = Washington State Model Toxics Control Act, Method A cleanup levels

PRG-Carc = Preliminary Remediation Goal - Carcinogen

PRG-Noncarc = Preliminary Remediation Goal - Noncarcinogen

RSL-RS = Regional Screening Level - Residential Soil

SS = Surface Soil

U = Analyte was not detected above the level of the associated value.

WB = Warmhouse Beach

WBB = Warmhouse Beach Background

APPENDIX A
SITE SPECIFIC SAMPLING PLAN

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10 Emergency Response Unit
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

Site Specific Sampling Plan

Project Name: **Warmhouse Beach Open Dump Removal Assessment** Site ID: **10HV**

Author: **Amy Dahl** Company: **TechLaw, Inc.** Date Completed: **February 18, 2010**

This Site Specific Sampling Plan (SSSP) is prepared and used in conjunction with the Quality Assurance Plan (QAP) for the Emergency Response Unit for collecting samples during this Removal Program project. The information contained herein is based on the information available at the time of preparation. As better information becomes available, this SSSP will be adjusted.

When inadequate time is available for preparing the SSSP in advance of the sampling event, a Field Sampling Form is prepared on-site immediately prior to sampling. The completed Field Sampling Form is attached to this full length version of the SSSP that is written after the sampling event.

1. Approvals

Name, Title	Telephone, Email, Address	Signature
Kathy Parker **On-Scene Coordinator (OSC)**	206-553-0062, parker.kathy@epa.gov USEPA , M/S: ECL-116, 1200 Sixth Ave. Suite 900, Seattle, WA 98101	Digitally signed by Kathy Parker DN: cn=Kathy Parker, o=Region 10, ou=ERU, email=parker.kathy@epa.gov, c=US Date: 2010.02.18 16:35:03 -08'00'
Michael Boykin **ERU Quality Assurance Coordinator**	206-553-6362, boykin.michael@epa.gov USEPA , M/S: ECL-116, 1200 Sixth Ave. Suite 900, Seattle, WA 98101	Michael Boykin Digitally signed by Michael Boykin DN: cn=Michael Boykin, o=US EPA R10, ou=Emergency Response Unit, email=boykin.michael@epa.gov, c=US Date: 2010.02.18 17:05:49 -08'00'

I. Project Management and Organization

2. Personnel and Roles involved in the project:

Name	Telephone, Email, Company, Address	Project Role	Data Recipient
Kathy Parker	206 553 0062, parker.kathy@epa.gov USEPA , M/S: ECL-116, 1200 Sixth Ave. Suite 900, Seattle, WA 98101	On Scene Coordinator/Project Manager	Yes
Amy Dahl	206 826 5375, adahl@techlawinc.com TechLaw, Inc., 1325 4th Ave, Suite 555, Seattle, WA 98101	Author of SSSP	No
Michael Boykin	206 553 6362, boykin.michael@epa.gov USEPA , M/S: ECL-116, 1200 Sixth Ave. Suite 900, Seattle, WA 98101	ERU Quality Assurance Reviewer	No
John Koehnen	360 871 8751, jkoehnen@techlawinc.com TechLaw, Inc. 7411 Beach Drive East, Port Orchard, WA 98366	START Project Manager	Yes
Maja Tritt	206 553 6265, tritt.maja@epa.gov USEPA, M/S: OEA-095, 1200 Sixth Ave. Suite 900, Seattle, WA 98101	CLP Laboratory Contact	No
Tom Pearson	360 871 8754, tpearson@techlawinc.com TechLaw, Inc. 7411 Beach Drive East, Port Orchard, WA 98366	START Quality Assurance Reviewer	No
Jennifer Crawford	206 553 6261, crawford.jennifer@epa.gov, USEPA , M/S: OEA-095, 1200 Sixth Ave. Suite 900, Seattle, WA 98101	Regional Sample Control Coordinator	No
Barry Pepich	360 871 8701, pepich.barry@epa.gov USEPA Region 10 7411 Beach Drive East, Port Orchard, WA 98366	MEL Laboratory contact	No

3. Physical Description and Site Contact Information:

Site Name	Warmhouse Beach Open Dump	
Site Location	Neah Bay, Washington, Clallam County.	
Property Size	7 acres	
Site Contact	Steve Pendleton Makah Environmental Division	**Phone Number: 360 645 3289**
Nearest Residents	2 miles	**Direction: southeast**
Primary Land Uses Surrounding the Site	The site is surrounded by dense forest.	

4. The proposed schedule of project work follows:

Activity	Estimated Start Date	Estimated Completion Date	Comments
SSSP Review/Approval	11/3/2009	1/10/2010	
Mobilize to / Demobilize from Site	1/25/2010	1/28/2010	
Sample Collection	1/25/2010	1/28/2010	
Laboratory Sample Receipt	1/29/2010	1/30/2010	Likely will require Saturday delivery
Laboratory Analysis	2/1/2010	2/22/2010	Standard turn around time of 21 days
Data Validation	2/24/2010	3/15/2010	

5. Historical and Background Information

Describe briefly what you know about the site that is relevant to sampling and analysis for this investigation.

The Warmhouse Beach Open Dump is located about 2 miles northwest of Neah Bay and one quarter mile south of the Straight of Juan de Fuca at an elevation of approximately 260 feet above mean sea level on the northern coast of the Makah Reservation. The dump is situated on a “saddle” between the drainage for West Creek to the southwest and East Creek to the southeast. Its northernmost extent is approximately 800 feet inland from the shoreline. The site is bordered by dense forests, with drainage to the east and west. West Creek outfalls at Warmhouse Beach and East Creek outfalls near Kydikabbit Point.

The Makah Air Force Station reportedly used the site from World War II until 1988, to dispose of household and various hazardous wastes, including paint cans, paint thinner, pesticides, lubricants, waste oil, asbestos-containing materials, empty barrels, and sewer sludge. Since 1988, members of the Makah Tribe, the US Coast Guard, local businesses and other agencies operating in the area have continued to use the open dump for disposal of municipal and hazardous solid waste.

Dumping reportedly began in a deep ravine that runs east and west along the south edge of the dump site. A bedrock ridge is about 70 feet above the top of the ravine. Waste materials were originally dumped into the ravine from the access road on the ravine’s south side. As the ravine filled with waste material, the access road was eventually extended to the top of the ridge. Since then, waste materials have been dumped from the top of the ridge down toward the ravine to the south. Some waste has also been dumped from the top of the ridge down toward the north and northwest.

As of 2003, the volume of waste was estimated to be within a range of 55,000 to 65,000 cubic yards. Waste materials have continued to be deposited at the site and the open dump is expected to reach capacity within the next few years.

Through a series of sampling events performed with funding from the Native American Environmental Mitigation Program, East and West Creeks were identified as being impacted by contaminants from the open dump. During a site visit in May 2009, OSC Parker observed the following materials at the dump site: household waste, batteries, electronic waste, appliances, medical waste, laboratory waste, bottles and barrels of petroleum products, herbicide containers, food waste, bottles of flammable liquids, and evidence of burning on the site including burned trees. Conversations with tribal members indicated West Creek is used for spiritual purposes which can include ingestion of creek water. The open dump is also believed to be a source of contamination of fish and the shellfish beds in the area which are used by the Tribe and local fishermen.

The Makah Tribe have designed and secured funding to build a transfer and recycling center in another location in the Neah Bay area. The transfer center is expected to be completed

within the next few years after which the Warmhouse Beach Open Dump will not be used. The open dump will then require closure (covering and preventing off-site drainage from the waste). In the interim, if contaminants are migrating off-site into surface water, a removal action may be warranted to minimize or eliminate this occurrence to protect human health and the local ecosystem until the open dump can be officially closed.

In November 2009, the Makah Tribal Council sent a letter to EPA requesting a Removal Assessment and a Preliminary Assessment.

6. Conceptual Site Model

Example: Contaminant: Mercury
Transport Mechanism: vapor moving on air currents
Receptors: people living in the house

Contaminants: Metals and benzene are present in groundwater; lead and arsenic were detected at concentrations above screening levels. Metals and diesel-range hydrocarbons are present in surface water; arsenic was detected at a concentration above the screening level. Concentrations of lead, nickel, and zinc in the stream samples from both creeks nearest to the waste exceeded screening levels.

Transport Mechanisms: The transport mechanisms may be erosion from wind, stormwater runoff, leaching, and direct contact by the public.

Receptors: This area has very high rainfall (approximately 100 inches per year) with 80% running off to streams because of the low permeability of the bedrock and soils and 20% lost to evapotranspiration. While groundwater is not believed to be a major receptor at this site, groundwater contamination has been observed in monitoring wells related to precipitation events and analytes of concern have been detected in groundwater above screening levels.

Conversations with tribal members indicate West Creek is used for spiritual purposes which can include ingestion of creek water.

Warmhouse Beach at the outlet of the west creek is prime habitat for marbled murrelet. Murrelet nesting in the area is inhibited by crows and seagulls using the dump site.

Runoff from the site can be carried by West and East Creeks into the waters of the Strait of Juan de Fuca, potentially impacting beach areas and the Strait. The Strait of Juan de Fuca is used for sport and subsistence fishing and shellfish collection. Aquatic life forms, including salmon, kelp beds and shellfish, may be exposed to toxics in the water and sediments that can kill or weaken them.

Humans may be directly exposed to contaminants through exposure resulting from unrestricted access to surface soils, sediment or water or through ingestion by consuming fish species caught from the river or mushrooms reportedly growing in contaminated soil. In addition, an historical fishing village in the area that is of archaeological value may have been impacted by the waste disposal practices.

7. Decision Statement

Examples: 1) Determine whether surface contamination exceeds the established action level;
2) Determine appropriate disposal options for contaminated materials.

The decisions to be made from this investigation are to:

1. Determine if target analyte concentrations in soil, sediments or water on or around the dump site exceed action levels.
2. Determine if target analytes are migrating off-site towards the Strait of Juan de Fuca.

8. Action Level

State the analyte, concentration, and units for each selected action level. Describe the rationale for choosing each action level and its source (i.e. MTCA, PRG, ATSDR, etc.) Example: The action level for total mercury in soil is 6.7 mg/kg (from Regional Screening Level residential).

Surface water and Synthetic Precipitation Leaching Procedure (SPLP) leachate results will be compared to the lowest of the following criteria: 1) National Recommended Water Quality Criteria for Human Health – Water and Organism, 2) Maximum Contaminant Level, or 3) the Regional Screening Level for tap water.

Soil and sediment results will be compared to the lowest of the following criteria: 1) State of Washington's Model Toxics Control Act, Method A cleanup levels (MTCA-A), 2) Regional Screening Level (RSL) Calculator - assuming *Dermal* Recreational exposure for 75 day/year, 3) RSL Calculator assuming *Ingestion* Recreational exposure, 4) RSL Calculator assuming *Inhalation* Recreational exposure, or 5) the RSL Tables for residential soil.

For analytes with no established criteria, the analytical result will be compared to the local background concentration to determine if further assessment is needed.

II. Data Acquisition and Measurement Objectives

9. Site Diagram and Sampling Areas

A Sampling Area is an area within in which a specific action will be performed.
Examples : 1) Each drum on the site is a Sampling Area;
2) Each section of sidewalk in front of the residence is a Sampling Area;
3) Each sampling grid section is a Sampling Area.

Diagram of site, with sampling areas:

10. The Decision Rules

These can be written as logical If…, Then.. statements. Describe how the decisions will be made and how to address results falling within the error range of the action level. Examples: 1) In the Old Furnace Sampling Area, the soil in the area around the furnace structure will be excavated until sample analysis with XRF shows no mercury concentrations in surface soil above the lower limit of the error associated with the action level, 18.4 mg/kg. 2) If the concentrations of contaminants in a SA are less than the lower limit of the error associated with the action level, then the area may be characterized as not posing an unacceptable risk to human health or the environment and may be dismissed from additional RP activities. The area may be referred to other Federal, State or Local government agencies.

The following statement(s) describe the decision rules to apply to this investigation:

If analytical results for target analytes in the samples exceed action levels, then the sample locations will be considered for potential further actions as determined by the OSC.

11. Information Needed for the Decision Rule

What information needs to be collected to make the decisions – this includes non-sampling info as well: action levels, climate history, direction of water flow, etc. Examples: Current and future on-site and off-site land use; wind direction, humidity and ambient temperature; contaminant concentrations in surface soil.

The following inputs to the decision rule are necessary to interpret the analytical results:

Locations of various waste disposal activities.

Hardness of water samples to perform calculations for metals.

Status of transfer station construction to determine timeline for dump closure.

12. Sampling and Analysis

For each SA, describe:

1. *sampling pattern (random, targeted, scheme for composite)*
2. *number of samples, how many to be collected from where, and why*
3. *sample type (grab, composite)*
4. *matrix (air, water, soil)*
5. *analytes and analytical methods*
6. *name and locations of off-site laboratories, if applicable.*

Waste Pile Area – Surface Soil Samples:

1) Judgmental, biased sampling approach
2) 6 samples – 4 samples to be collected at the perimeter of the waste pile area, one field duplicate (FD), and one background sample
3) Grab Samples using stainless steel spoons
4) Surface Soil Matrix
5) Target Analyte List (TAL) Metals by EPA 6010 or 6020 or CLPAS ILM05.4
   Volatile Organic Compounds (VOC) by EPA 8260 or CLPAS SOM01.2
   Semi-volatile Organic Compounds (SVOC) by EPA 8270 or CLPAS SOM01.2
   Polychlorinated biphenyls (PCB)/Pesticides by EPA 8081A and 8082 or CLPAS SOM01.2
   Total Petroleum Hydrocarbons – Diesel Range Organics (TPH-Dx) by EPA 8015B or NWTPH-Dx
   Total Petroleum Hydrocarbons – Gasoline Range Organics (TPH-Gx) by EPA 8015B or NWTPH-Gx
   Dioxins by EPA 8280B or 8290A or DLM02.0
   Explosives by EPA 8095 or 8330A
   Perchlorate by EPA 6860 or 332.1
   Polybrominated diphenyl ethers (PDBEs) by EPA 3570 and 8270D SIM (FD not to be analyzed)
6) Lab to be determined by EPA Laboratory Coordinator

Waste Pile Area – Waste Samples:

1) Judgmental, biased sampling approach
2) 5 samples – 4 samples to be collected randomly within the waste pile area, collecting at least one sample from the lower layers representing possible military waste and one field duplicate

3) Grab Samples using stainless steel trowels
4) Waste Sample Matrix
5) Synthetic Precipitation Leaching Procedure (SPLP) by EPA 1312 followed by:
   TAL Metals by EPA 6010 or 6020 or CLPAS ILM05.4
   VOCs by EPA 8260 or CLPAS SOM01.2
   SVOCs by EPA 8270 or CLPAS SOM01.2
6) Lab TBD by EPA Laboratory Coordinator

East and West Creeks – Sediment Samples:

1) Judgmental, biased sampling approach (co-located with surface water samples)
2) 15 samples – one upstream background, five along each creek, one at each creek outfall (Warmhouse Beach for West Creek and the beach near Kydikabbit Point for East Creek), and two field duplicates
3) Grab Samples
4) Sediment Matrix
5) TAL Metals by EPA 6010 or 6020 or CLPAS ILM05.4
   VOCs by EPA 8260 or CLPAS SOM01.2
   SVOCs by EPA 8270 or CLPAS SOM01.2
   PCBs/Pesticides by EPA 8081A and 8082 or CLPAS SOM01.2
   TPH-Dx by EPA 8015B or NWTPH-Dx
   TPH-Gx by EPA 8015B or NWTPH-Gx
   Dioxins by EPA 8280B or 8290A or DLM02.0
   Explosives by EPA 8095 or 8330A
   Perchlorate by EPA 6860 or 332.1
   PDBEs by EPA 3570 and 8270D SIM (FDs not to be analyzed)
6) Lab TBD by EPA Laboratory Coordinator

East and West Creeks – Water Samples:

1) Judgmental, biased sampling approach (co-located with sediment samples)
2) 17 samples – one upstream background, five along each creek, one at each creek outfall (Warmhouse Beach for West Creek and the beach near Kydikabbit Point for East Creek), two field duplicates, one rinsate blank, and one trip blank (for VOCs)
3) Grab Samples
4) Surface Water Matrix
5) Total and Dissolved TAL Metals and Hardness by EPA 6010 or 6020 or CLPAS ILM05.4
   VOCs by EPA 8260 or CLPAS SOM01.2
   SVOCs by EPA 8270 or CLPAS SOM01.2
   PCBs/Pesticides by EPA 8081A and 8082 or CLPAS SOM01.2
   TPH-Dx by EPA 8015B or NWTPH-Dx
   TPH-Gx by EPA 8015B or NWTPH-Gx
   Dioxins by EPA 8280B or 8290A or DLM02.0
   Explosives by EPA 8095 or 8330A
   Perchlorate by EPA 6860 or 332.1
   pH by EPA 9040C or 150.1
6) Lab TBD by EPA Laboratory Coordinator

13. Applicability of Data (place an X in front of the data categories needed, explain with comments)

Do the decisions to be made from the data require that the analytical data be:
1) definitive data, 2) screening data (with definitive confirmation) or 3) screening data (without definitive confirmation)?

_X__A) Definitive data *is analytical data of sufficient quality for final decision-making. To produce definitive data on-site or off-site, the field or lab analysis will have passed full Quality Control (QC) requirements (continuing calibration checks, Method Detection Limit (MDL) study, field duplicate samples, field blank, matrix spikes, lab duplicate samples, and other method-specific QC such as surrogates) AND the analyst will have passed a Precision and Recovery (PAR) study AND the instrument will have a valid Performance Evaluation sample on file. This category of data is suitable for:* ***1) enforcement purposes, 2) determination of extent of contamination, 3) disposal, 4) RP verification or 5) cleanup confirmation.***
Comments: For all analytes except field parameters.

_X__B) Screening data with definitive confirmation *is analytical data that may be used* ***to support preliminary or intermediate decision-making*** *until confirmed by definitive data. However, even after confirmation, this data is often not as precise as definitive data. To produce this category of data, the analyst will have passed a PAR study to determine analytical error AND 10% of the samples are split and analyzed by a method that produced definitive data with a minimum of three samples above the action level and three samples below it.*
Comments: pH and other water quality parameters requiring immediate analysis will be analyzed on-site.

____C) Screening data *is analytical data which has not been confirmed by definitive data. The QC requirements are limited to an MDL study and continuing calibration checks. This data can be used for making decisions:* ***1) in emergencies, 2) for health and safety screening, 3) to supplement other analytical data, 4) to determine where to collect samples, 5) for waste profiling, and 6) for preliminary identification of pollutants****. This data is not of sufficient quality for final decision-making.*
Comments:

14. Special Sampling or Analysis Directions

Describe any special directions for the planned sampling and analysis such as additional quality controls or sample preparation issues. Examples: 1) XRF and Lumex for sediment will be calibrated before each day of use and checked with a second source standard. 2) A field blank will be analyzed with each calibration to confirm the concentration of non-detection. 3) A Method Detection Limit determination will be performed prior to the start of analysis so that the lower quantitation limit can be determined. 4) If particle size is too large for accurate analyses, the samples will be ground prior to analysis. If the sample contains too much moisture for accurate analyses, the sample will be decanted and air dried prior to analysis.

1. Waste samples to be collected for SPLP leaching will be collected in 5-gallon buckets. Judgment will be used to obtain a representative sample of a cube with a height, width and length of one foot.

2. If waste particle size is too large for accurate analyses, the samples will be cut or ground prior to analysis.

3. If soil particle size is too large for accurate analyses, the samples will be ground at the lab prior to analysis.

4. Additional volume will be collected for MS/MSD analysis at a frequency of 1 per 20 per matrix.

5. Surface water samples for dissolved metals will be filtered at the end of each day using a peristaltic pump and 0.45µm inline filter.

6. Surface water samples for perchlorate will be filtered at the end of each day using a syringe and 0.2 µm sterile filter cartridge.

15. Method Requirements

[Describe the restrictions to be considered in choosing an analytical method due to the need to meet specific regulations, policies, ARARs, and other analytical needs. Examples: 1) Methods must meet USEPA Drinking Water Program requirements. 2) Methods must achieve lower quantitation limits of less than 1/10 the action levels.3) Methods must be performed exactly as written without modification by the analytical laboratory.]

Methods must satisfy the requirements of the EPA Site Assessment Unit for possible use in scoring the site for the National Priorities List (NPL).

16. Sample Collection Information

[Describe any activities that will be performed related to sample collection]

The applicable sample collection Standard Operating Procedures (SOPs) or methods will be followed and include:

Maintaining a Field Activity Logbook SOP
Taking and Documenting Photographs SOP
Surface Water Sampling SOP
Surface/Near Surface Soil Samples SOP
Chain-Of-Custody SOP Sampling
Equipment Decontamination SOP
Personal Protective Equipment SOP

17. Optimization of Sampling Plan (Maximizing Data Quality While Minimizing Time and Cost)

[Describe what choices were made to reduce cost of sampling while meeting the needed level of data quality. Example: The XRF will be used in situ whenever possible to achieve accurate results. Reproducibility and accuracy of in situ XRF analyses will be checked by collecting, air drying, analyzing and comparing five in situ samples at the start of sampling. Where interferences are suspected, steps will be taken to eliminate the interferences by mechanisms such as drying, grinding or sieving the samples or analyzing them using the Lumex with soil attachment.]

The results from this Removal Assessment may be used for a planned Preliminary Assessment.

The format for sample number identification is summarized in Table 1. Sample collection and analysis information is summarized in Table 2.

Table 1 SAMPLE CODING
Project Name: Warmhouse Beach Open Dump Project ID: SSID: 10HV

SAMPLE NUMBER [(1)]		
Digits	**Description**	**Code (Example)**
1,2,3,4	Year and Month Code	YYMM (0911)
5,6,7,8	Consecutive Sample Number (grouped by SA as appropriate)	4000 – First sample 4049 – last sample

SAMPLE NAME / LOCATION ID [(2)]		
1,2	Sampling Area	CR – Creek BG – Background RS – Rinsate TB – Trip Blank WP – Waste Pile
3,4	Consecutive Sample Number	01 – First sample of SA.
5,6	Matrix Code	WM – Waste Material SD – Sediment SS – Surface Soil SW – Surface Water WT – Water

Notes: (1) The Sample Number is a unique, 8-digit number assigned to each sample.
(2) The Sample Name or Location ID is an optional identifier that can be used to further describe each sample or sample location.

Table 2. Sampling and Analysis: Warmhouse Beach Open Dump

Data Quality	Sampling Area	Matrix	Number Of Field Samples	Analyte or Parameter	Method Number	Action Level	Method Quant. Limit	Field QC	Preserv/ Hold Time
Lab Analysis	Waste Pile	Soil	6 (4 samples 1 background 1 duplicate)	TAL Metals	EPA 6020 or 6010 or CLPAS ILM05.4	See Excel spreadsheet	See Excel spreadsheet	1 Duplicate 1 MS/MSD	None, prep within 180 days[a]
				VOCs	EPA 8260 or CLPAS SOM01.2				Cool, extract within 14 days
				SVOCs	EPA 8270 or CLPAS SOM01.2				Cool, extract within 14 days
				PCB/ Pesticides	EPA 8081A and 8082 or CLPAS SOM01.2				Cool, extract within 14 days
				TPH-Dx	EPA 8015B or NWTPH-Dx				Cool, extract within 14 days
				TPH-Gx	EPA 8015B or NWTPH-Gx				Cool, extract within 14 days
				Dioxins	EPA 8280B or 8290A or DLM02.0				None, none
				Explosives	EPA 8095 or 8330A				None, none
				Perchlorate	EPA 6860 or 332.1				Cool, extract within 28 days
Lab Analysis	Waste Pile	Waste Material	5 (4 samples 1 duplicate)	SPLP-Metals	EPA 1312 plus EPA 6020 or 6010 or CLPAS ILM05.4	See Excel spreadsheet	See Excel spreadsheet	1 Duplicate 1 MS/MSD	None, 180 days to leach[b]
				SPLP-VOCs	EPA 1312 plus EPA 8260 or CLPAS SOM01.2				None, 14 days to leach
				SPLP-SVOCs	EPA 1312 plus EPA 8270 or CLPAS SOM01.2				None, 14 days to leach

a Hold-time for mercury is 28 days.
b Samples must be leached within 28 days for SPLP-mercury.

Table 2. Sampling and Analysis: Warmhouse Beach Open Dump (continued)

Data Quality	Sampling Area	Matrix	Number Of Field Samples	Analyte or Parameter	Method Number	Action Level	Method Quant. Limit	Field QC	Preservation/ Hold Time
Lab Analysis	Creek	Sediment	15 (12 samples 1 background 2 duplicates)	TAL Metals	EPA 6020 or 6010 or CLPAS ILM05.4	See Excel spreadsheet	See Excel spreadsheet	2 Duplicates 1 MS/MSD	None, prep within 180 days [a]
				VOCs	EPA 8260 or CLPAS SOM01.2				Cool, extract within 14 days
				SVOCs	EPA 8270 or CLPAS SOM01.2				Cool, extract within 14 days
				PCB/ Pesticides	EPA 8081A and 8082 or CLPAS SOM01.2				Cool, extract within 14 days
				TPH-Dx	EPA 8015B or NWTPH-Dx				Cool, extract within 14 days
				TPH-Gx	EPA 8015B or NWTPH-Gx				Cool, extract within 14 days
				Dioxins	EPA 8280B or 8290A or DLM02.0				None, none
				Explosives	EPA 8095 or 8330A				None, none
				Perchlorate	EPA 6860 or 332.1				Cool, extract within 28 days
Lab Analysis	Creek	Surface Water	33 (12 samples 1 background 2 duplicates 3 blanks 15 dissolved samples)	T&D TAL Metals/ Hardness	EPA 6020 or 6010 or CLPAS ILM05.4	See Excel spreadsheet	See Excel spreadsheet	2 Duplicates 1 MS/MSD 1 Rinsate Blank 1 Filter Blank 1 Trip Blank[c]	HNO3 to pH<2, 180 days [a]
				VOCs	EPA 8260 or CLPAS SOM01.2				HCl to pH<2, cool, analyze within 14 days
				SVOCs	EPA 8270 or CLPAS SOM01.2				Cool, extract within 7 days
				PCB/ Pesticides	EPA 8081A and 8082 or CLPAS SOM01.2				Cool, extract within 7 days
				TPH-Dx	EPA 8015B or NWTPH-Dx				HCl to pH<2, cool, extract within 14 days
				TPH-Gx	EPA 8015B or NWTPH-Gx				HCl to pH<2, cool, extract within 14 days
				Dioxins	EPA 8280B or 8290A or DLM02.0 or EPA 1613 or 513				Cool, none
				Explosives	EPA 8095 or 8330a or 529				Cool, none
				Perchlorate	EPA 6860 or 332.1				0.2um sterile filtration, cool, analyze within 28 days
				pH	EPA 9040C or 150.1				Analyze at laboratory upon receipt

c Trip Blank analyzed for VOCs only.

III Assessment and Response

A Sample Plan Alteration Form (SPAF) will be used to describe project discrepancies (if any) that occur between planned project activities listed in the final SSSP and actual project work. The completed SPAF will be approved by the OSC and QAC and appended to the original SSSP.

A Field Sampling Form (FSF) may be used to capture the sampling and analysis scheme for emergency responses in the field and then the FSF pages inserted into the appropriate areas of the final SSSP.

Corrective actions will be assessed by the sampling team and others involved in the sampling and a corrective action report describing the problem, solution and recommendations will be forwarded to the OSC and the ERU QAC.

IV Data Validation and Usability

The sample collection data will be entered into Scribe and Scribe will be used to print lab Chains of Custody. Results of field and lab analyses will be entered into Scribe as they are received and uploaded to Scibe.net when the sampling and analysis has been completed.

18. Data Validation or Verification will be performed by:
(Mark as appropriate and elaborate if necessary)

_ Ecology and Environment Quality Assurance Officer, validation
_ Techlaw Quality Assurance Officer, validation
X EPA Region 10 Quality Assurance Office, validation
X Manchester Environmental Lab (MEL) staff, verification
_ Other _____

19. Data Validation Type will be:
_ Stage IIA, percentage to be validated
_ Stage IIB, percentage to be validated
_ Stage III, percentage to be validated: 10% CLP data
_ Stage IV, percentage to be validated: all Dioxin data
_ Verification, percentage: all MEL data

APPENDIX B
SAMPLE PLAN ALTERATION FORM

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 10 Emergency Response Unit
Site Specific Sampling Plan Alteration Form

Project Name: Warmhouse Beach Open Dump Site ID: 10HV
Author: Amy Dahl Company: TechLaw, Inc. Date Completed: February 8, 2010

Changes from Final SSSP (include rationale, decision area, matrices, parameters, equipment, personnel, etc.:

1. Based on cost and sample volume required, the analyte list for SPLP was reduced from the full list of analytes for this Removal Assessment to the analytes routinely analyzed in SPLP leachates (metals, VOCs, and SVOCs).
2. Because waste samples would be heterogeneous and not representative of the entire variety of waste present on site without collecting a large number of samples, it was decided in the field to perform SPLP on the four soil samples collected total analyses, for the full list of analytes rather than on separate waste samples. The soil samples collected from the outer footprint of the dump are expected to be impacted by the runoff from a larger area of waste materials than would be represented by a single waste sample. Further, no field duplicate will be analyzed for SPLP due to heterogeneity of the soil samples, cost, and limited usability of precision data for this method. A duplicate of one soil sample will be analyzed for the full analyte list to provide an indicator of precision for this matrix.
3. Due to the difficulty accessing the outlets of the West and East Creek at the beach on the Straight of Juan de Fuca and near impossibility of carrying the entire suite of sample bottles required up the steep incline and through the dense brush, no samples were collected at the beach outlets of the West and East Creeks. Additionally, one less sample was collected on East Creek than on West Creek due to the shorter length of the accessible reach of the creek (660 feet for East Creek vs. 1050 feet for West Creek).
4. In order to provide better background information for the surface water and sediment matrices, one additional background site was sampled for surface water and sediment and submitted for the same analyses. The two background sample sites were Classet Creek and a site near the source of an unnamed creek that meets with East Creek near Kydikabbit Point.
5. Due to cost, initial dioxin analyses were limited to eight samples: four soil samples (no duplicate) and two sediment samples each from East and West Creeks in the areas closest to the site. If dioxins are detected in any of the sediment samples, additional sediment and surface water samples may be submitted for dioxin analysis.
6. In the initial SSSP, pH was listed for laboratory analysis and was not measured in the field. However, pH was not scheduled for laboratory analysis because the holding time for pH is 15 minutes. pH was analyzed for all water samples by ESAT on Friday, January 29, 2009 according to EPA Method 150.1.

Approvals of SSSP Alteration Form		
Name	**Title**	**Signature**
Kathy Parker	On-Scene Coordinator (OSC)	Digitally signed by Kathy Parker DN: cn=Kathy Parker, o=Region 10, ou=ERU, email=parker.kathy@epa.gov, c=US Date: 2010.02.18 16:39:04 -08'00'
Michael Boykin	Emergency Response Unit (ERU) Quality Assurance Coordinator (QAC) or alternate	Michael Boykin Digitally signed by Michael Boykin DN: cn=Michael Boykin, o=US EPA R10, ou=Emergency Response Unit, email=boykin.michael@epa.gov, c=US Date: 2010.02.18 17:06:50 -08'00'

APPENDIX C
FIELD LOG NOTES

"Rite in the Rain"®
ALL-WEATHER WRITING PAPER

ALL-WEATHER

ENVIRONMENTAL FIELD BOOK

Name BRYAN BERNA

Address 7411 BEACH DR E.
PORT ORCHARD, WA

Phone 360-871-8787

Project WARM HOUSE BEACH
CONTRACT

This book is printed on "Rite in the Rain" All-Weather Writing Paper - A unique paper created to shed water and enhance the written image. It is widely used throughout the world for recording critical field data in all kinds of weather. For best results, use a pencil or an all-weather pen.

Specifications for this book:

Page Pattern		Cover Options	
Left Page	Right Page	Polydura Cover	Fabrikoid Cover
Columnar	1/4" Grid	Item No. 550	Item No. 550F

DE # 006-09-10-0011 DCN627

CONTENTS

PAGE	REFERENCE	DATE

Reference Page Index

147 Error codes, Hazardous classifications, Container types
148 Sampling guidelines (Liquids)
149 Sampling guidelines (Solids)
150 Approximate Volume of Water in Casing or Hole, Ground Water Monitoring Well
151 PVC Pipe casing tables
152 Soil Classification
153 Soil Classification
154 Conversions (Length, Weight, Volume, Temp, etc...)
155 Conversions (Concentrations, Volume/Flow or Time, Velocity, Acceleration)
156 Maximum Concentration of Contaminants for the Toxicity Characteristic

CONTENTS

PAGE	REFERENCE	DATE
	Disclamer; this logbook contains info. regarding Warmhouse Beach open Dump located in Neah Bay, WA. This information is considered confidential. Should this logbook be found, it is requested by the USEPA that it be returned to either:	
	Tech Law	
	ATTN Bryan Berna or	
	7411 Beach Dr E	
	P.O. WA, 98366	
	EPA	
	Kathy Parker	
	1200 6th Ave Ste 900	
	Sea, WA 98101	
	* All samples are collected per standard operating procedures found in the SSSP / SQAP	
	BBerna 1/25/10	

Location Warmhouse Date 1/25/10

Project / Client Neah Bay, WA

Potential site work

once open Dump

1 ~~Sub~~ Closed in 60's

50 Koitlah Point Dump

300 Road named same

Rotafi will send DATA of potential sampling at waters edge for PCBs

Steve

Wa'di Island w/ Break water

Future Novlap 2005-2007

PCB hits come unknown. Access issues with undercut bank and limited Beach during high tide.

1500 onsite w/ KP, MH, AD & BB to scout West creek and acquire GPS points and relative distances of Dump & creek length.

off site @ 1728

BB

Location WARMHOUSE BEACH Date 1/26/10

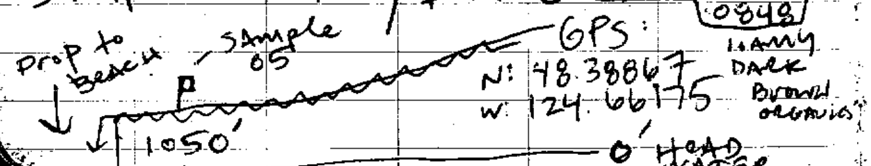
Project / Client

NEAH BAY, WA

[0730] onsite w/ K.P. (Kathy Parker) Jason McCarty (ERRS) and TL's Amy Dahl, Mike Habe & Bryan Berna (author). Reviewed HASP (signed yesterday) and proceeded to position sampling gear @ the identified West Creek sample locations (done 1/25). Jason located background water sed locat. for future sampling.

[0830] All sampling equipment has been stationed.

[0845] Water sample WBW-05-SW collected 18' ~~upst~~ upstream of water fall that drops 125' est to beach access. photo #0100- on BB camera. (see photo log in back of log book. Sample collected by SOP (as all) Sampler Amy Dahl [WBW-05-SD 0848]



GPS: N: 48.38867 W: 124.66175

loamy dark brown organics

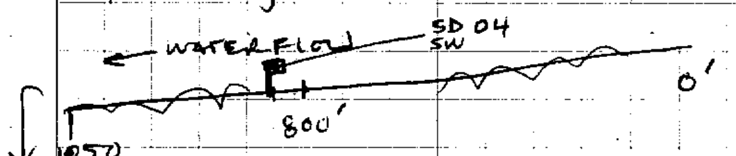
Location WARMHOUSE BEACH Date 1/26/10

Project / Client

NEAH BAY, WA

[0950] sample location [WBW-04-SW] collected by Amy Dahl 800' downstream from West Creek headwater. Water depth 5" collected under 3' diameter nurse log. No GPS available due to overhead tree canopy

[1010] [Sample # WBW-04-SD] collected 1' downstream of water location. Soils are loamy organics w/ fine silt (top 1") & clay beneath (down to 4"). collected by A.D. Photo # 100-267

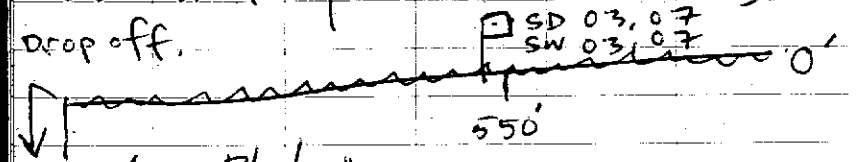


[1100] Samples# WBW-03-SW
WBW-07-SW
collected by AD from small fall 8" high water transferred from 1L amber to 40 mL VOAs to prevent preservative spill
WBW-07-SW is duplicate of WBW-03-SW.

Location WARMHOUSE B. Date 1/26/10

Project / Client NEAH BAY, ~~WA~~ WA

1115 SAMPLE # WBW-03 - SD & DUPLICATE SAMPLE WBW-07 - SD, COLLECTED BY AD.. SEDIMENTS ARE CLAY W/ IRON STAINING. SMALL GRAVEL SITS ON TOP. CLAY 2-4" DEEP. 03, 07 COLLECTED 550' DOWN STREAM OF HEAD WATERS.

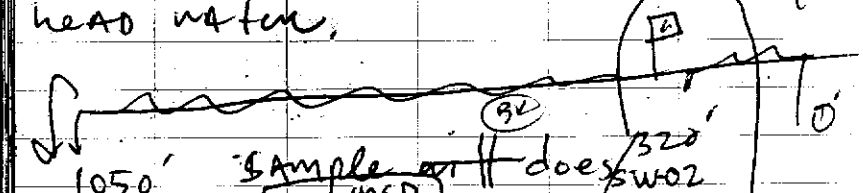


DROP OFF.

PHOTO # 100-268 NO GPS

DUE TO TREE CANOPY. BREAK FOR LUNCH @ 12:10 - 12:30

1255 SAMPLE # WBW-02-SW COLLECTED BY MS. AMY DAHL FROM WEST CREEK 320' DOWNSTREAM OF HEAD WATER.



~~SAMPLE~~ DOES CONTAINS MS MSD

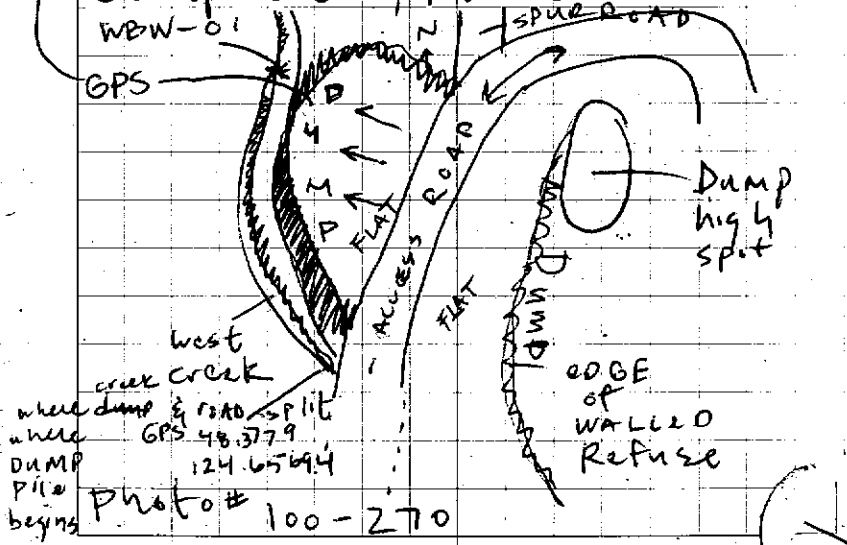
PHOTO # 100-269 LOOKING NORTH NO GPS DUE TO TREE COVER.

Location WARMHOUSE BEACH Date 1/26/10

Project / Client NEAH BAY, WA

1305 SAMPLE # WBW-02-SD COLLECTED FROM SAME LOCATION ALSO MS/MSD.

1410 SAMPLE # WBW-01-SW COLLECTED FROM 105' DOWN STREAM OF HEAD WATER THE SAMPLE IS 25 I/NEAR (HORIZONTALLY) W. FROM GPS N 48.38829 W 124.65789. THIS READING WAS CAPTURED FROM THE NW CORNER OF PUSHED DUMP EDGE, ~~ALONG~~ OFF OF ACCESS ROAD.



Location Warmhouse Beach Date 1/26/10

Project / Client
NEAH BAY, WA

[1430] WBW-01-SD collected.
1 foot downstream, soils where silty mud w/ organics.
collected by Amy Dahl.

[1600] WBB-06-SW collected from ~~C~~ claret creek approximately 350' downstream from road surface soils & ~~vegetation~~ is similar to west creek. GPS
W → taken at road creek runs to west
photo 100-271

[1638] WBB-06-SD collected
4' downstream sediments are light brown with gravel over top, silty ~~clay~~ clay beneath. similar to SW 05
Bryan Berna sampler of SW, SD - 06.

[1655] WBB - 06 - SS collected
12' up the bank of the small stream used for back

Location Warm House Date 1/26/10

Project / Client
NEAH BAY, WA

ground surface water.
Soils are loamy heavy ~~dark~~ Brown w/ clay
collected by B.B.
GPS not available due to tree cover. All three background samples are taped from the road @ 405' A correction to the estimated distance previously noted
N. 48.38526 (27' acc)
W. 124.65265
GPS at roads edge (west)
SS, SD, SW - 06 405' west of this location.

[1715] offsite

(BB)

Location WAREHOUSE BEACH Date 1/27/10

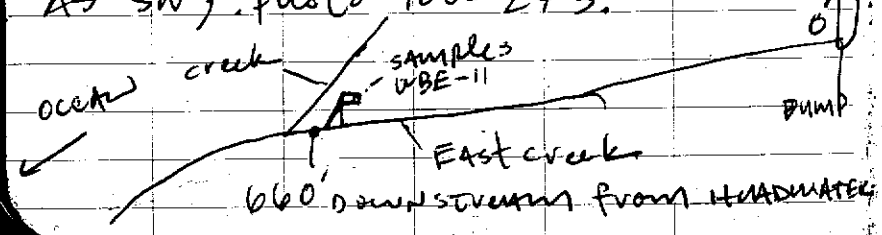
Project / Client NEAH BAY, WA

0745 onsite. AD, MH, BRYAN BERNA (Log book). Positioning sampling kits @ locations on WARMHOUSE BEACH ~~East~~ (WBE) creek.

1000 sample WBE-11-SW collected by A.D 50' south of junction between creek & EAST creek. Down creeks Flow to SJD. GPS 48.38906 124.65340 11' ~~24'~~

70' above sea level. DUMP ACCESS ROAD; Level of HEAD WATERS of EAST creek is @ 200' ABOVE S.L.

1020 sample WBE-11-SD collected by A.D. 3' DOWNSTREAM of SW. soils are loamy w/ organics & fine SAND. GPS ABOVE (same AS SW). photo 100-273.



Location WARMHOUSE BEACH Date 1/27/10

Project / Client NEAH BAY, WA

1031 AD collects WBE-10-SW @ 440' downstream of HEAD WATER GPS 48.38861 elevation 117' 124.65428

1050 AD collects WBE-10-SD SEDS are fine grained w/ little silt. photo 273-4 looking down hill N/E toward junction of creeks. Sample within 5' of SW,

1120 AD collects WBE-09-SW DUP - WBE-12-SW

N 48.38868 elevation 178' W 124.65463 ABOVE SEA LEVEL

1200 AD collects WBE-09-SD Duplicate-WBE-012-SD

SEDS ~~Soils~~ are SMALL GRAVEL, silt SAND. DARK BROWN & tan (rock) 300' downstream of HEADWATER heading back to ACCESS ROAD @ 12:45. Photo 100-275

Location WARMHOUSE BEACH Date 1/27/10

Project / Client NEAR BAY, NEAR BAY, WA

1335 sample collected @ location WBE-08-SW by AMY DAHL 120' DOWNstream of head WATERS AT MONITORING well. GPS N. not available due to W. CANOPY coverage elevation N/A yet.

This is the first sample located DOWNSTREAM of Dump. on East creek.

1355 sample WBE-08-SD collected by A.D. SEDS are light brown, clay, small pebbles dryer than previous, twigs Root (organics). GPS is same as SW. Photo same as SW.

1438 2ND Background collected 340' East of culvert on creek. Same location that Dodhalfi uses for monitoring. & WBB-013-SW. collected by BRYAN BERNA.

Location WARMHOUSE BEACH Date 1/27/10

Project / Client NEAR BAY, WA

1500 WBB-13-SD collected by bryan AND BERNA. SEDS ARE DARK BROWN MUD consistency, clay w/ ORGANIC DEBRIS fine pebbles on top 1/8". GPS N48 38182 W122.62329

From this point on ROAD GO South west 45' into woods creek runs Nearly parallel At this pt. 1530 AMY & KP Are determining location for SPLP/Soil samples. 4 selected 2 on or near top of open dump. 2 on lower level EACH potentially impacting the respective E & W creeks.

1605 WB-14-SS collected by AMY DAHL. SAMPLE is from a pushed soils pile. GPS N 48.38923 W W124.65746 elevation 293' soils are DARK BROWN w/ rock chip soils have been moved to

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Location Warmhouse Beach Date 1/27/09

Project / Client Neah Bay, WA

this location to cover-up trash. photo # 100- Looking NW towards ocean.

1630 sample WB-15-SS collected by Bryan Beaver. location is the SE EDGE of upper pump AREA. N 48.38841 W 124.65598 elevation 245' Above S.L. soils ~~are~~ for heavily influenced by trash, small bits of glass, metals, plastics < 5 mm

1645 WB-16-SS AD sample GPS N 48.38836 W 124.65768 246' ABSL 50' from edge of pushed dump

1650 WB-17-SS sample BB WB-18-SS (duplicate) N 48.38815 W 124.65607 244 ABSL

Location Warmhouse Beach Date 1/27/09

Project / Client Neah Bay, WA

Monitoring well GPS
N 48 38809
124 65565

pH WATERS using WHATMAN pH INDICATION PAPER Type CF Cat No. 2613991 pH 0-14

Sample #	(Paper) pH	Accumet pH meter cal 4 & 7 Buffer. slope = 96.7 pH
01	7	6.89
02	7	7.06
03	7	7.24
04	7	7.08
05	7	7.27
06	7	6.65
07	7	7.33
08	7	7.14
09	7	7.48
10	7	7.62
11	7	7.62
12	7	7.65
13	7	6.62

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Location _____ Date _____

Project / Client _____

Location WARM HOUSE BEACH Date 1/25/10

Project / Client Photo Log 1/ /10

Photo #	Sample ID	Taken By	Facing	Witness
100-266	WBW-05	BB	N	AD
100-267	WBW-04	BB	N	AD
100-268	WBW-03 WBW-07	BB	N	MH
100-269	WB-02	BB	N	MH
100-270	WB-01	BB	N	MH
100-271	WBB-06	BB	W	MH
100-272	WBB-06-SS	BB	S	MH
100-273	WBE-11-SW SD	BB	W	AD

Photo #	Sample #	Facing	Init
~~100-266~~	~~WBW-05-SW/SD~~	~~N~~	~~AD~~
~~100-267~~	~~WBW-04-SW/SD~~	~~N~~	~~AD~~
-268	WBW-03-SW/SD W-07-SW/SD	N	MH
-269	WBW 02 - SW/SD	N	MH
-270	WBW01 - SW/SD	N	MH
-271	WBB-06-SW/SD	W	MH
~~-272~~	~~WBB-05-SD~~	~~S~~	~~MH~~
-273	WBE-11-SW/SD	W	AD
-274	WBE-10-SD SW	NE	
-275	WBE-09-SD SW Dup WBE-12-SD	NW	

APPENDIX D
PHOTOGRAPHIC LOG FOR JANUARY 2010 SAMPLING EVENT

PHOTOGRAPH #1

Description: Southern boundary of uncontrolled landfill. East Creek headwaters are located in back left corner.

Taken by:	Amy Dahl, TechLaw Inc.	Direction:	East
Witness:	Bryan Berna, TechLaw Inc.	Date:	January 25, 2010

PHOTOGRAPH #2

Description: Uncontrolled landfill; upper level has metal debris exposed on the hillside.

Taken by:	Amy Dahl, TechLaw Inc.	Direction:	North
Witness:	Bryan Berna, TechLaw Inc.	Date:	January 25, 2010

PHOTOGRAPH #3

Description: Site entry road and a warning sign.

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Taken by:	Amy Dahl, TechLaw Inc.	Direction:	Northwest
Witness:	Bryan Berna, TechLaw Inc.	Date:	January 25, 2010

PHOTOGRAPH #4

Description: Site entry road; West Creek headwaters are to the left.

Taken by:	Amy Dahl, TechLaw Inc.	Direction:	Northwest
Witness:	Bryan Berna, TechLaw Inc.	Date:	January 25, 2010

PHOTOGRAPH #5

Description: View of surface water and sediment samples WBW-01-SW/SD, located 105' downstream from West Creek headwaters.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	North
Witness:	Mike Hase, TechLaw Inc.	Date:	January 26, 2010

PHOTOGRAPH #6

Description: View of surface water and sediment samples WBW-03-SW/SD and their duplicates WBW-07-SW/SD, located 550' downstream from West Creek headwaters.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	North
Witness:	Mike Hase, TechLaw Inc.	Date:	January 26, 2010

PHOTOGRAPH #7

Description: View of surface water and sediment samples WBW-04-SW/SD, located 800' downstream from West Creek headwater.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	North
Witness:	Amy Dahl, TechLaw Inc.	Date:	January 26, 2010

PHOTOGRAPH #8

Description: View of surface water and sediment samples WBW-05-SW/SD, located 18' upstream of West Creek waterfall that drops roughly 125' to beach access.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	North
Witness:	Amy Dahl, TechLaw Inc.	Date:	January 26, 2010

PHOTOGRAPH #9

Description: View of surface soil sample WBB-06-SS, located 12' up the bank of the small stream used for the background surface water sample.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	West
Witness:	Mike Hase, TechLaw Inc.	Date:	January 26, 2010

PHOTOGRAPH #10

Description: View of surface water and sediment samples WBE-09-SW/SD and their duplicates WBE-12-SW/SD, located 300' downstream of East Creek headwaters.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	Northeast
Witness:	Amy Dahl, TechLaw Inc.	Date:	January 27, 2010

PHOTOGRAPH #11

Description: View of surface water and sediment samples WBE-10-SW/SD, located 440' downstream from East Creek headwaters.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	North
Witness:	Mike Hase, TechLaw Inc.	Date:	January 27, 2010

PHOTOGRAPH #12

Description: View of surface water and sediment samples WBE-11-SW/SD, located 50' south of the junction between the East Creek and an unnamed feeder creek joining from the east.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	South
Witness:	Amy Dahl, TechLaw Inc.	Date:	January 27, 2010

PHOTOGRAPH #13

Description: View of surface soil sample WB-14-SS, from a bulldozed soils pile.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	West
Witness:	Mike Hase, TechLaw Inc.	Date:	January 27, 2010

PHOTOGRAPH #14

Description: View of surface soil sample WB-15-SS, located on the southeast edge of upper landfill area.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	Southeast
Witness:	Amy Dahl, TechLaw Inc.	Date:	January 27, 2010

PHOTOGRAPH #15

Description: View of surface soil sample WB-16-SS, located 50' from the edge of the bulldozed landfill.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	Northwest
Witness:	Mike Hase, TechLaw Inc.	Date:	January 27, 2010

PHOTOGRAPH #16

Description: View of surface soil sample WB-17-SS and its duplicate WB-18-SS.

Taken by:	Bryan Berna, TechLaw Inc.	Direction:	Southeast
Witness:	Mike Hase, TechLaw Inc.	Date:	January 27, 2010

APPENDIX E
PHOTOGRAPHIC LOG FOR MAY 2009 SITE VISIT

Warmhouse Beach Open Dump Removal Assessment
Clallam County, Washington

Photos by: Kathy Parker

Photo 1: Entrance to dump

Direction: W Date: 5/13/2009

Photo 2: Sign at entrance to dump

Direction: NW Date: 5/13/2009

Photo 3: Road within dump

Direction: W Date: 5/13/2009

Photo 4: Top of dump

Direction: N Date: 5/13/2009

Warmhouse Beach Open Dump Removal Assessment
Clallam County, Washington

Photos by: Kathy Parker

Photo 5: Roofing shingles at top of dump

Direction: Date: 5/13/2009

Photo 6: East side of top of dump

Direction: W Date: 5/13/2009

Photo 7: Headwaters of West Creek

Direction: W Date: 5/13/2009

Photo 8: Entrance to headwaters of East Creek

Direction: N Date: 5/13/2009

Warmhouse Beach Open Dump Removal Assessment
Clallam County, Washington

Photos by: Kathy Parker

Photo 9: Drum containing oily liquid at top of dump
Direction: Date: 5/13/2009

Photo 10: Laboratory waste on top of dump
Direction: Date: 5/13/2009

Photo 11: Batteries found on surface of dump
Direction: Date: 5/13/2009

Photo 12: Medical waste found on surface at top of dump
Direction: Date: 5/13/2009

Warmhouse Beach Open Dump Removal Assessment
Clallam County, Washington

Photos by: Kathy Parker

Photo 13: Burned trees near top of dump

Direction: Date: 5/13/2009

Photo 14: Flammable liquid container found at top of dump

Direction: Date: 5/13/2009

Photo 15: Burned tire rim and steel belting at top of dump

Direction: Date: 5/13/2009

Photo 16: Refrigerator at top of dump

Direction: Date: 5/13/2009

Warmhouse Beach Open Dump Removal Assessment
Clallam County, Washington

Photos by: Kathy Parker

Photo 17: Can of solvent found at top of dump

Direction: Date: 5/13/2009

Photo 18: Roofing shingles found at top of dump

Direction: Date: 5/13/2009

Photo 19: Birds feeding on food waste in dump

Direction: Date: 5/13/2009

Photo 20: Chemical Container found at top of dump

Direction: Date: 5/13/2009